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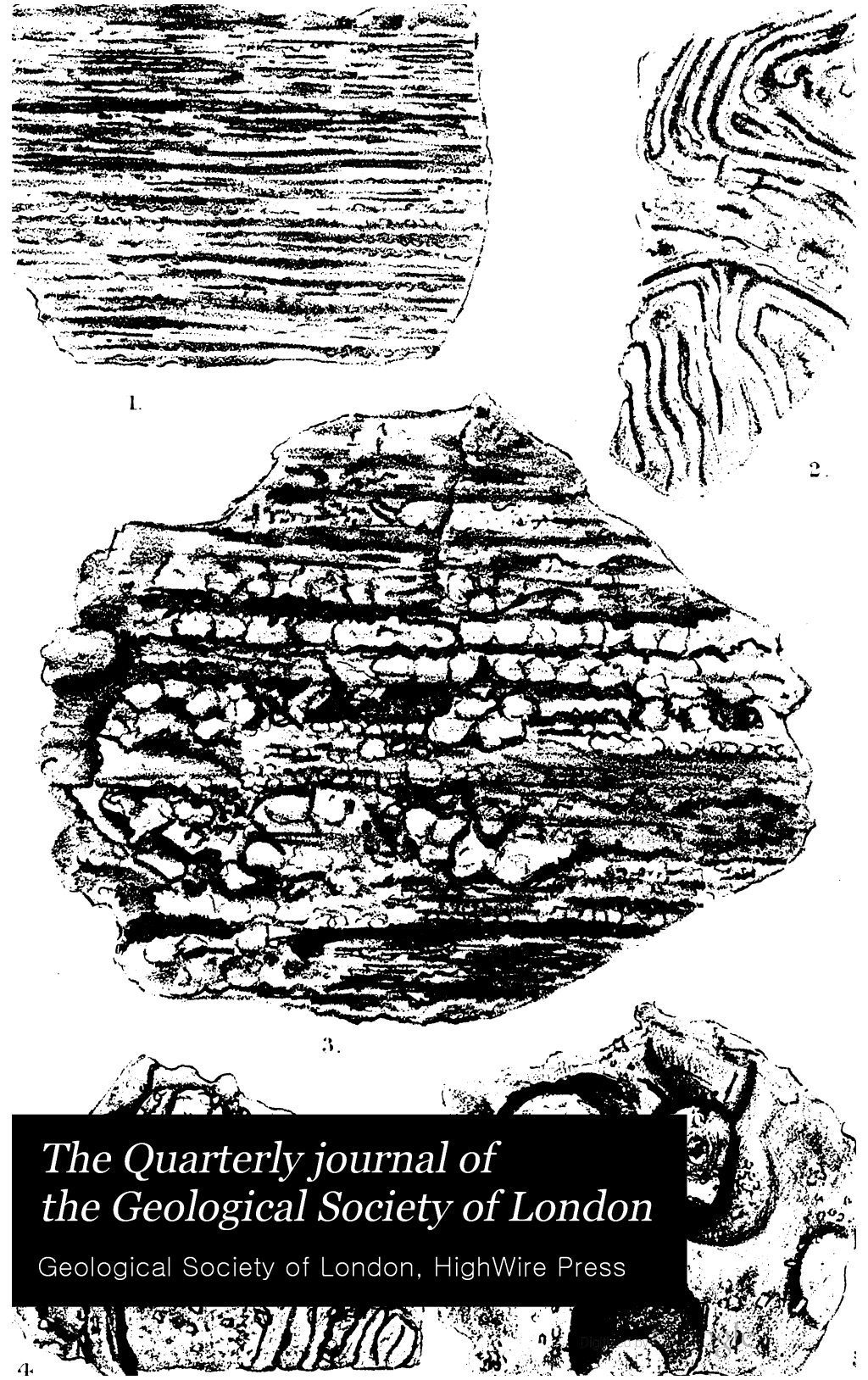
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The Quarterly journal of the Geological Society of London

Geological Society of London, HighWire Press

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Vol. XLIX. FEBRUARY 1st, 1893. **No. 193.**
PART 1.

2598

THE

QUARTERLY JOURNAL

OF THE

GEOLOGICAL SOCIETY.

EDITED BY

THE ASSISTANT-SECRETARY.

LONDON:

LONGMANS, GREEN, AND CO.

PARIS:—FRIED. KLINCKSIECK, 11 RUE DE LILLE; F. SAVY, 24 RUE HAUTEFEUILLE. LEIPZIG: T. O. WEIGEL.

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TO BE HELD AT BURLINGTON HOUSE.

SESSION 1892–93.

1893.

February 8-22
(Anniversary) Friday, Feb. 17th.
March 8-22
April 12-26
May 10-24
June 7-21

[Commence at Eight o'Clock precisely each Evening.]

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[No. 194 will be published on the 1st of next May.]

[The Editor of the Quarterly Journal is directed to make it known to the Public, that the Authors alone are responsible for the facts and opinions contained in their respective Papers.]

*** The Council request that all communications intended for publication by the Society shall be clearly and legibly written on one side of the paper only, with proper references, and in all respects in fit condition for being at once placed in the Printer's hands. Unless this is done it will be in the discretion of the Officers to return the communication to the Author for revision.

The Library and Museum at the Apartments of the Society are open every Weekda from Ten o'clock until Five, except during the first two weeks in the month (September, when the Library will be closed for the purpose of clean Library is also closed on Saturdays at One P.M. during the months of A September. It is open until Eight P.M. on the Days of Meeting for books, and from Eight P.M. until the close of each Meeting for con purposes only.

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Fellows on election pay an Admission Fee of Six Guineas. The Annual Contribution paid by Fellows is Two Guineas, due on the 1st of January in every year, and payable in advance; but Fellows elected after the month of February are subject only to a proportionate part of the Contribution for the year in which they are elected; and Fellows elected in November or December pay no Contribution for the current year. The Annual Contribution may at any time be compounded for by a payment of Thirty Guineas.

The Fellows are entitled to receive gratuitously all the volumes or parts of volumes of the Quarterly Journal of the Society that may be published after their election, so long as their Annual Contributions are paid; and they may purchase any of the publications of the Society at a reduction of 25 per cent. under the selling prices.

The Library is open daily to the Fellows between the hours of 10 and 5 (except during the first two weeks of September), and on Meeting days until 8 P.M. Under certain restrictions Fellows are allowed to borrow books from the Library.

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PROCEEDINGS

OF THE

GEOLOGICAL SOCIETY OF LONDON.

SESSION 1892–93.

November 9th, 1892.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

William Gregson, Esq., Baldersby, Thirsk, Yorkshire, was elected a Fellow of the Society.

The List of Donations to the Library was read.

The following communications were read:—

1. "A Sketch of the Geology of the Iron, Gold, and Copper Districts of Michigan." By Prof. M. E. Wadsworth, Ph.D., A.M., F.G.S.[1]

2. "The Gold-quartz Deposits of Pahang (Malay Peninsula)." By H. M. Becher, Esq., F.G.S., Assoc.R.S.M.

3. "The Pambula Gold-deposits." By F. D. Power, Esq., F.G.S.

The following specimens were exhibited:—

Auriferous Rock from the Pambula Gold Deposits, exhibited by F. D. Power, Esq., F.G.S., in illustration of his paper.

Specimens from the Michigan Ore Deposits, exhibited by H. Bauerman, Esq., F.G.S.

A series of Restorations of Extinct Animals, drawn by Mr. J. Smit, exhibited by the Rev. H. N. Hutchinson, B.A., F.G.S.

Plant-remains from the Old Red Sandstone of the Auchendoir (Rhynie) Quarries, near Gartly (Aberdeenshire), exhibited by Major R. T. W. Lambart Brickenden, F.G.S.

[1] This paper has been withdrawn by permission of the Council.

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November 23rd, 1892.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

John Walker Stather, Esq., 16 Louis Street, Hull, was elected a Fellow of the Society.

The List of Donations to the Library was read.

The following communications were read:—

1. "Outline of the Geological Features of Arabia Petræa and Palestine." By Prof. Edward Hull, LL.D., F.R.S., F.G.S.

[Abstract.]

The region may be considered as physically divisible into five sections, viz.:—(i) The mountainous part of the Sinaitic peninsula; (ii) the table-land of Badiet-el-Tîh and Central Palestine; (iii) the Jordan-Arabah valley; (iv) the table-land of Edom, Moab, and the volcanic district of Jaulân and Haurân; and (v) the maritime plain bordering the Mediterranean.

The most ancient rocks (of Archæan age) are found in the southern portion of the region; they consist of gneissose and schistose masses penetrated by numerous intrusive igneous rocks. They are succeeded by the Lower Carboniferous beds of the Sinaitic peninsula and Moabite table-land, consisting of a bluish limestone, with fossils which have their counterparts chiefly in the Carboniferous Limestone of Belgium, and of a purple and reddish sandstone (called by the Author 'the Desert Sandstone,' to distinguish it from the Nubian Sandstone of Cretaceous age), lying below the limestone. The Nubian Sandstone, separated from the Carboniferous by an enormous hiatus in the succession of the formations, is probably of Neocomian or Cenomanian age, and is succeeded by white and grey marls, and limestones-with-flint, with fossils of Turonian and Senonian ages.

The Middle Eocene (Nummulitic Limestone) beds appear to follow on those of Cretaceous age without a discordance; but there is a real hiatus notwithstanding the apparent conformity, as shown by the complete change of fauna. In Philistia a calcareous sandstone, in which no fossils have been observed, is referred to the Upper Eocene; for the Miocene period was a continental one, when faulting and flexuring was taking place, and the main physical features were developed—*e. g.*, the formation of the Jordan-Arabah depression is referable to this period.

In Pliocene times a general depression of land took place to about 200–300 feet below the present sea-level, and littoral deposits were formed on the coasts and in the valleys. To this period belong the higher terraces of the Jordan-Arabah valley. The Pliocene deposits consist of shelly gravels. Later terraces were formed at the epoch of the glaciation of the Lebanon Mountains, when the rainfall was excessive in Palestine and Arabia.

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The volcanoes of the Jaulân, Haurân, and Arabian Desert are considered to have been in active operation during the Miocene, Pliocene, and Pluvial periods; but the date of their final extinction has not been satisfactorily determined.

Discussion.

The President remarked on the interest of the geology of an area which was that of the Bible. Many authors had recorded their observations on this district, one of the latest being the Author of this paper. Some years ago Mr. Holland had read a paper before the Society, and he (the speaker) believed that that writer was actually the first to prove the existence of Carboniferous fossils in the Sinaitic peninsula. He remarked that *Lepidodendron mosaicum*, described by Salter, was somewhere preserved in the Society's museum, so that the Society had long ago had evidence of Carboniferous rocks. Mr. Bauerman's paper, which was a reconnaissance in a comparatively unknown district, created great interest; and when that paper was read, doubt was expressed as to whether the fossils then exhibited were Carboniferous or Triassic. After the researches of Prof. Hull, there was no doubt that Carboniferous rocks do occur in the region. As regards the granitic rocks (extending far up the Nile Valley, in the Sinaitic peninsula, and elsewhere), they were all of much the same character, and, according to Sir William Dawson, occurred at two horizons—the lower rocks being granitoid and gneissic, the upper more or less volcanic, but still pre-Carboniferous. He asked the Author whether the 'Poudingues de Jebel Haroûn' of Lartet were or were not ancient volcanic rocks.

The Nubian Sandstone of older writers included many things, but the age of the various sandstones was now satisfactorily determined by the Author. Some were Carboniferous, others (in the speaker's opinion) Cenomanian. The calcareous formations of Judæa were well known from the writings of Lartet, Fraas, and others; but the exact line of demarcation between the Nummulitic Limestone and the true Cretaceous had never been determined. It was a curious fact, as stated by Zittel, that not one fossil was common to the two deposits, which were nevertheless quite conformable.

Miocene beds appeared to be absent, for, as noted by Lartet and confirmed by the Author, this was a period of movement, when the great valley and the great fault were initiated. He (the speaker) felt that there were many difficulties connected with the depression which had not yet been cleared up. Lartet, Hitchcock, and others had traced the general direction of the fault; but the Author had determined its exact site at more than one point.

The most interesting point in this connexion was the question of the age of the 700-foot saddle separating the Akabah watershed from the Jordan-Arabah depression. This saddle, in fact, separates the Jordan-Arabah depression from the Red Sea basin. Was it probable that this saddle was contemporaneous with the longitudinal fracture? Much depended on the determination of this

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question. Canon Tristram had shown that the fishes of the Jordan waters presented some curious analogies with the fish fauna of those of Africa, and Günther, after studying his specimens, had confirmed this view. He (the speaker) believed that this connexion was not over the saddle of the Arabah, but might have been the 285-foot pass of the gorge of Jezreel. If the Pliocene depression, which the Author thought was at least 200 feet, was a little greater, it would at least cause an outflow in this direction.

As to the date of the basaltic eruptions, he thought the Author's explanation was not unreasonable. He remarked that the Jordan-Arabah valley must have been of considerable antiquity, and had many lateral valleys of erosion more or less pointing towards the central hollow of the Dead Sea, whether from the Jordan or the Arabah end. Whither had the material thus eroded gone? It could not have passed over the saddle into the Red Sea, for the drainage had evidently been towards the Dead Sea for ages. He allowed that much was soluble limestone; but that must be precipitated somewhere, and the only conclusion he could come to was the somewhat heretical belief that the bottom of the Dead Sea had been an unsound one.

Dr. Irving referred to the characterless facies of the Nubian Sandstone in the Wady Halfa region as recently observed by Capt. H. G. Lyons, F.G.S.; also to the remarkable density of the waters of the Dead Sea, as showing evaporation to be the true cause of the low level of its waters, while the non-felspathic character of the volcanic rocks of the Jordan basin, and the consequent deficiency of alkaline carbonates in the surface-waters, seemed fully to account for the abnormally large amount of chlorides of lime and magnesia which the Dead Sea waters hold in solution, salts which by reactions with alkaline carbonates would otherwise be precipitated as dolomite. He agreed with the President that the former connexion of the Jordan basin with the sea was probably by the valley and plain of Jezreel. He thought the unmetamorphosed condition of the pre-Carboniferous volcanic rocks described by the Author of great interest, as bearing upon theories as to metamorphism. He also thought that students of Biblical literature owed a debt of gratitude to the Author for his researches.

Mr. J. Bridges Lee said that in the North-western Himalayas he had traced extensive deposits of volcanic trap, of undoubtedly pre-Carboniferous age, the whole way from the neighbourhood of the Baralacha Pass, at the north-western corner of Spiti, through Zanskar, Suru, Dras, and a large part of Cashmere. Every appearance would seem to indicate that these volcanic rocks extended originally in continuous sheets over immense tracts of country. On the south side of the great central chain of the Himalayas they are found now in more or less scattered and detached masses; but on the north, throughout the whole length of Zanskar and Suru (where there has been less denudation than to the south), there is an almost continuous outcrop visible. It might be interesting to ascertain whether the pre-Carboniferous rocks of Palestine are contemporaneous with

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and generally similar to the Himalayan rocks. It is a remarkable fact that some of the most notable of the Buddhist monasteries of Zanskar and Suru are built on the line of outcrop of these rocks. Pooktal, Thonde, and Ringdom monasteries are examples; and while the trap forms one of the best geological landmarks throughout a large part of the North-western Himalayas, it would also seem to have some especial interest for large numbers of Buddhist priests, who have elected to build their monasteries and to live upon it.

Messrs. Topley, Hinde, and Whitaker also spoke.

The Author accounted for the change of species between the Cretaceous and Eocene Limestones, as determined by Zittel, by supposing that at the close of the Cretaceous period the sea-bed had been elevated into a land-surface—but without flexuring—owing to which the life-forms of the Cretaceous ocean were destroyed, and upon re-submergence new forms entered from the outer ocean; in this way there would be no appreciable discordance of stratification, but complete change of species. As regards the origin of the saddle in the Arabah Valley, he believed it was formed during the formation of the valley itself, not subsequently; the valley contracted very much at the saddle.

In reply to Mr. Topley's question, the Author stated he had been informed that there was a very distinct terrace of gravel near the Lake of Huleh, corresponding in level with that in the Arabah Valley; about 1200 feet above the Dead Sea surface the intermediate representatives of this terrace may be found, but doubtless had been to a large extent swept away by floods and rains.

In attempting to account for the difference between the faunas of the Red Sea and Mediterranean, it would be clear that once the Isthmus of Suez had been converted into land, and the seas dissevered, differentiation would begin and proceed till all the forms unsuited to each had disappeared; difference in the temperature of the waters of the two seas would be the chief cause of differentiation.

2. "The Base of the Keuper Formation in Devon." By the Rev. A. Irving, B.A., D.Sc., F.G.S.

3. "The Marls and Clays of the Maltese Islands." By John H. Cooke, Esq., B.Sc., F.G.S.

Specimens of breccia were exhibited by the Rev. A. Irving, B.A., D.Sc., F.G.S., in illustration of his paper.

December 7th, 1892.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

Robert Aird, Esq., M.A., Killean Place, Campbeltown, N.B.; Charles Anthony Benn, Esq., B.A., Inner Temple, E.C., and Pudleston Court, Leominster; Arthur Launcelot Collins, Esq., Kabul,

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Afghanistan; John Dixon, Esq., Government Inspector of Collieries, Merewether, near Newcastle, New South Wales; John Fraser, M.D., M.A., Chapel Ash, Wolverhampton; Horace Broughton Nash, Esq., 23 Victoria Road, Barnsley; William Charles Northcott, M.A., LL.D., Rochester House, Ealing, W.; Frederick Richard Cowper Reed, Esq., B.A., Trinity College, Cambridge; Edmund Spargo, Esq., Artido House, Kensington, W., and 3 Cable Street, Liverpool; E. Kemper-Voss, Esq., Kimberley, South Africa; and Richard Henry Walcott, Esq., London Street, Dunedin, Otago, New Zealand, were elected Fellows of the Society.

The List of Donations to the Library was read.

The PRESIDENT announced that the American Philosophical Society will celebrate the one hundred and fiftieth anniversary of its foundation at Philadelphia, from May 22nd to May 26th, 1893. Fellows of the Geological Society who propose to be in Philadelphia during that week, and who may wish to participate in the celebration as representatives of the Society, are requested to communicate with the Assistant Secretary, Burlington House, W.

The following communications were read:—

1. "Note on the Nufenenstock (Lepontine Alps)." By Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., V.P.G.S.

2. "On some Schistose 'Greenstones' and allied Hornblendic Schists from the Pennine Alps, as illustrative of the Effects of Pressure-Metamorphism." By Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., V.P.G.S.

3. "On a Secondary Development of Biotite and of Hornblende in Crystalline Schists from the Binnenthal." By Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., V.P.G.S.

4. "Geological Notes on the Bridgewater District in Eastern Ontario." By J. H. Collins, Esq., F.G.S.

[Abstract.]

The plateau of the Bridgewater district consists chiefly of gneiss and mica-schist, with subordinate beds of white marble, quartz-conglomerate and quartzite, and some veins of 'giant-granite.' The general dip of the gneissose series is eastward.

The Author notes the effect of frost in splitting off flakes of the gneissose rocks and conglomerates, especially on the bare glaciated surfaces, and suggests that many of the smaller and shallower lakelets may have originated by this process.

The conglomerates are described as gneisses and mica-schists, with subordinate pebble-beds.

The occurrence of gold in quartz-veins near Flinders and at Madoc is noted; and amongst other economic products are the micas of the

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granites, asbestiform actinolite, and marble. The Author discusses the mode of origin of the granite, marble, and actinolite-rock.

Discussion.

The President remarked that the Author seldom failed to make good use of his time when travelling. The conditions displayed in his principal section might possibly be explained on the shearing theory, two different sets of beds being sandwiched into one another. But this could scarcely account for the peculiar relations of the quartz-conglomerates to the Author's gneisses and mica-schists. We might believe almost anything of these very ancient (Archæan) rocks.

Dr. Hicks asked what was the evidence to show that the gneiss was of the same age as the conglomerates and shales? Were there not evidences of faults such as would cause two distinct series to be brought together in apparent sequence?

Dr. Hinde did not think the Author was right in attributing the origin of the lakelets and basin-like rock-depressions in the districts referred to, to the action of frost in exfoliating the rock-surfaces; for in this case they would not show the glacial striæ and polishing now present, not only in the raised bosses but in the hollows as well. The débris resulting from exfoliation, if such had taken place to any extent, would also have prevented the frost from penetrating deep enough to form the hollows.

Mr. Monckton also spoke.

The Author, in reply to the President and to Dr. Hicks, said that he thought the shale-actinolite series might be of different age from that of the gneiss-conglomerate series; the strike was perhaps not precisely the same, and the junction was concealed by a stream. But the stratigraphic relations of the conglomerate-beds were perfectly clear, and he had no doubt whatever as to their forming part of the gneissic series. He applied the term 'gneiss,' as it was generally used in Canada, to a more or less foliated crystalline rock consisting of quartz, felspar, and mica in varying proportions. He did not really think the marbles were segregations, but the suggestion had been made and he thought it worthy of some consideration. In reply to Dr. Hinde, he said that only the smaller lakelets could be formed by frost-flaking, and perhaps he ought to have spoken of these as rock-pools rather than lakelets. The flakes did not accumulate, because they were soon split up into minute fragments by succeeding frosts and removed by the winds.

The following specimens were exhibited:—

Rock-specimens and microscopic sections, exhibited by Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., V.P.G.S., in illustration of his papers.

Rock-specimens and photographs, exhibited by J. H. Collins, Esq., F.G.S., in illustration of his paper.

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December 21st, 1892.

Prof. J. W. JUDD, F.R.S., Vice-President, in the Chair.

Basil Wilfred Bowdler, Esq., 2nd Lieutenant R.E., Chatham; Edward Power, Esq., 12 Bolton Gardens, South Kensington, S.W.; and William Frederick Smeeth, Esq., B.A., Assoc.R.S.M., Demonstrator in Geology in the University of Sydney, N.S.W., 8 Mall Road, Hammersmith, W., were elected Fellows of the Society.

The List of Donations to the Library was read.

Two documents, which had belonged to the late Sir Richard Owen, were presented by C. Davies Sherborn, Esq., F.G.S.

The CHAIRMAN gave expression to the Society's deep sense of the loss which it had just sustained by the death of so distinguished a Fellow as Sir Richard Owen, who had been associated with the Society for no less than fifty-five years. He further announced that the Council, in causing a resolution of condolence to be forwarded to the bereaved family, had deputed Dr. Hicks and himself to represent the Society at Sir Richard's funeral.

In explanation of certain specimens of fossils exhibited by J. V. Parkes, Esq., F.G.S., and found in limestones about 11 miles north of Beltana Township, South Australia, Dr. G. J. HINDE said that the limestone-slabs forwarded by Mr. Parkes were filled with the peculiar fossils belonging to the family Archæocyathinæ, which had been considered as probably allied to Perforate Corals. These fossils were widely distributed in rocks of Cambrian age in various parts of the world, having been found in Nevada, Labrador, Spain, and Sardinia, and they had lately been recognized in the same district in South Australia as that whence Mr. Parkes's specimens had been obtained, and an excellent description and figures of them were given by Mr. R. Etheridge, jun., in the 'Transactions of the Royal Society of South Australia,' 1890, pp. 10–22, pls. ii., iii.

The following communications were read:—

1. "On a Sauropodous Dinosaurian Vertebra from the Wealden of Hastings." By R. Lydekker, Esq., B.A., F.G.S.

2. "On some additional Remains of Cestraciont and other Fishes in the Green Gritty Marls, immediately overlying the Red Marls of the Upper Keuper in Warwickshire." By the Rev. P. B. Brodie, M.A., F.G.S.

3. "*Calamostachys Binneyana*, Schimp." By Thomas Hick, Esq., B.A., B.Sc. Communicated by J. W. Davis, Esq., F.G.S., F.L.S.[1]

[1] This paper has been withdrawn by permission of the Council.

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4. "Notes on some Pennsylvanian Calamites." By W. S. Gresley, Esq., F.G.S.

[Abstract.]

The Author believes that a group of specimens from the Pottsville conglomerate series demonstrates that the so-called Calamite-casts in sandstone are not always to be regarded as casts of pith-cavity only, but are often casts of the vascular cylinder as well; also that these specimens show that some Calamites, at all events, possessed furrowed exteriors or barks. A specimen from the Pittston bed of anthracite in the Wyoming basin also seems to suggest that the true bark had not always a smooth exterior.

A specimen from the same geological horizon as the last specimen, and from a neighbouring locality, indicates a Calamite of gigantic proportions. Another specimen, from the Pittsburgh bed, is remarkable as showing two branch-scars not on, but below the nodes of the Calamite.

5. "Scandinavian Boulders at Cromer." By Herr Victor Madsen, of the Danish Geological Survey. Communicated by J. W. Hulke, Esq., F.R.S., For.Sec.G.S.

The following specimens, in addition to those above mentioned sent by Mr. Parkes, were exhibited:—

Specimen and cast of Dinosaurian Vertebræ, exhibited by R. Lydekker, Esq., B.A., F.G.S., in illustration of his paper.

Specimens of a 'Bone-bed' with Fish-remains, from the Green Marls below the *Avicula contorta*-shales at Gold Cliff, Monmouthshire. Collected by H. B. Woodward, Esq., F.G.S., and A. Strahan, Esq., M.A., F.G.S. Exhibited by permission of the Director-General of the Geological Survey.

'Rhomben-Porphyr,' Christiania District, found at Cromer by J. J. H. Teall, Esq., M.A., F.R.S., F.G.S., and Clement Reid, Esq., F.L.S., F.G.S. Exhibited by permission of the Director-General of the Geological Survey.

January 11th, 1893.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

George William Card, Esq., Assoc.R.C.S., Assoc.R.S.M., Curator and Geologist to the Geological Survey of New South Wales, Sydney, New South Wales; and William Morris, Esq., M.Inst.C.E., Kent Waterworks, Deptford, S.E., were elected Fellows of the Society.

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The following Fellows, nominated by the Council, were elected Auditors of the Society's accounts for the preceding year:—T. V. Holmes, Esq.; H. W. Monckton, Esq., F.L.S.

The List of Donations to the Library was read.

The following communications were read:—

1. "Variolite of the Lleyn, and associated Volcanic Rocks." By Catherine A. Raisin, B.Sc. Communicated by Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., V.P.G.S.

2. "On the Petrography of the Island of Capraja." By Hamilton Emmons, Esq. Communicated by Sir Archibald Geikie, D.Sc., LL.D., For.Sec.R.S., F.G.S.

The following specimens were exhibited:—

Rock-specimens and microscopic sections, exhibited by Miss Catherine A. Raisin in illustration of her paper.

Photographs of the Island of Capraja, exhibited by Hamilton Emmons, Esq., in illustration of his paper.

At a Special General Meeting, held at 7.55 P.M., before the Ordinary Meeting, the appointment of Henry Franklin and his wife to the respective posts of House-Porter and Upper-Housemaid to the Society was confirmed by the Fellows.

January 25th, 1893.

W. H. HUDLESTON, Esq., M.A., F.R.S., President, in the Chair.

George Bastable Laffan, Esq., B.Sc., Assoc.M.Inst.C.E., 4 Walpole Road, Twickenham, was elected a Fellow of the Society.

The List of Donations to the Library was read.

The following communications were read:—

1. "On Inclusions of Tertiary Granite in the Gabbro of the Cuillin Hills, Skye; and on the Products resulting from the Partial Fusion of the Acid by the Basic Rock." By Prof. J. W. Judd, F.R.S., V.P.G.S.

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2. "Anthracite and Bituminous Coal-beds. An Attempt to throw some light upon the manner in which Anthracite was formed; or Contributions towards the Controversy regarding the Formation of Anthracite." By W. S. Gresley, Esq., F.G.S.

[Abstract.]

The Author does not seek to advance any new theory in this communication, nor to proclaim new facts of any importance, but to put old facts in something of a new light, in order to aid the investigations of others. His main object is to establish two facts, viz.:—that the associated strata of anthracite-beds are more arenaceous than those containing so-called bituminous coal-beds, and that the prevailing colours of the sandstones, grits, etc., of anthracite regions are greyer and darker than those of regions of bituminous coal. To these facts may perhaps be added a third, that the more anthracitic the coal-beds, and the more siliceous the enclosing strata, the harder and tougher these associated strata are.

While recognizing that the rocks of many anthracite regions have undergone great disturbance, he cites other areas where coal-basins have been much folded, without any corresponding production of anthracite in considerable quantity.

The modes of occurrence of anthracite are illustrated by many instances observed by the Author in the Old and New Worlds.

Discussion.

The President observed that the apparently greater abundance of anthracite in arenaceous rocks may be due to chemical causes. Perhaps the gases escaped from the coal through these porous strata, whereas they were 'bottled up' in argillaceous strata and so preserved the bituminous character of the coals.

Prof. Hull remarked that the question whether the anthracitic condition of coal-seams depended on the predominance of sandstones amongst the associated strata, as he understood the Author to suggest, would require careful observation of the sections of particular coalfields, but was one which deserved attention. If we were to take, for example, the South Wales Coal-basin, it would be interesting to ascertain whether sandstones predominated in the western parts of that basin where anthracite was found, and shales in the eastern parts where the coal was bituminous. This might be done by a comparison of vertical sections of the strata, and if found to be the case, the argument would have some weight that, owing to the greater porosity of the sandstones over the shales, the escape of the gaseous products had been easier where these were in excess than where the less porous shales predominated. But this would not wholly account for the production of anthracite, which probably depended for its origin on a variety of conditions.

The following specimens were exhibited:—

Rock-specimens exhibited by Prof. J. W. Judd, F.R.S., V.P.G.S., in illustration of his paper.

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Rock-specimens and microscope-slides exhibited by W. S. Gresley, Esq., F.G.S., in illustration of his paper.

Rock-specimens sent by Herr Victor Madsen to illustrate his paper on "Scandinavian Boulders at Cromer," read on Dec. 21st, 1892.

February 8th, 1893.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

Harry George Mantle, Esq., Melrose House, near Lichfield, was elected a Fellow of the Society.

The List of Donations to the Library was read.

The following communications were read:—

1. "Notes on some Coast-Sections at the Lizard." By Howard Fox, Esq., F.G.S., and J. J. H. Teall, Esq., M.A., F.R.S., F.G.S.

2. "On a Radiolarian Chert from Mullion Island." By Howard Fox, Esq., F.G.S., and J. J. H. Teall, Esq., M.A., F.R.S., F.G.S.

3. "Note on a Radiolarian Rock from Fanny Bay, Port Darwin, Australia." By G. J. Hinde, Ph.D., V.P.G.S.

4. "Notes on the Geology of the District west of Caermarthen." Compiled from the Notes of the late T. Roberts, Esq., M.A., F.G.S. (Communicated by Prof. T. McKenny Hughes, M.A., F.R.S., F.G.S.)

The following specimens were exhibited:—

Rock-specimens and microscopic sections exhibited by Howard Fox, Esq., F.G.S., and J. J. H. Teall, Esq., M.A., F.R.S., F.G.S., in illustration of their papers.

Microscopic preparations of Radiolarian Chert from Mullion Island, exhibited by Dr. G. J. Hinde, V.P.G.S., in illustration of his Appendix to Messrs. Fox and Teall's paper on that chert.

Microscopic preparations of a Radiolarian Rock from Fanny Bay, Port Darwin, exhibited by Dr. G. J. Hinde, V.P.G.S., in illustration of his paper.

Specimens of the Radiolarian Rock from Fanny Bay described by Dr. G. J. Hinde, V.P.G.S., exhibited by Sir Archibald Geikie, LL.D., For. Sec.R.S., F.G.S.

Specimens of Graptolites exhibited by J. E. Marr, Esq., M.A., F.R.S., Sec.G.S., in illustration of the paper compiled from the Notes of the late T. Roberts, Esq., M.A., F.G.S.

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ANNUAL GENERAL MEETING,

February 17th, 1893.

W. H. HUDLESTON, Esq., M.A., F.R.S., President, in the Chair.

REPORT OF THE COUNCIL FOR 1892.

WHILE the Council are once more in a position to congratulate the Fellows on the very satisfactory condition of the Society's finances, they feel it is their duty to point out that, for the first time since 1888, the number of Fellows, instead of increasing, has slightly diminished.

The number of Fellows elected during the past year was 40, of whom 33 paid their fees before the end of the year, making, with 18 previously elected Fellows who paid their fees in 1892, a total accession in the course of the twelvemonth of 51 Fellows.

During the same period, however, there was a total loss of 70 Fellows—38 by death, 15 by resignation, 14 removed from the list for non-payment of their Annual Contributions, and 3 (2 of whom were non-Contributors and 1 was a Compounder) removed from the list after having remained thereon for many years without any known address.

The actual decrease in the number of Fellows is, therefore, 19.

Of the 38 Fellows deceased, 6 were Compounders, 24 were Contributing Fellows, and 8 were non-Contributing Fellows.

On the other hand, in 1892, 6 Fellows compounded for their Annual Contributions.

From the above figures it will be seen that, in the number of Contributing Fellows, the actual decrease is 8, making a total of 896 Contributing Fellows, as compared with 904 at the end of the previous year.

The total number of Fellows, Foreign Members, and Foreign Correspondents, which, on December 31st, 1891, had been 1418, stood at 1400 on the last day of 1892.

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At the end of 1891, there was 1 vacancy in the list of Foreign Members, and also 1 vacancy in the list of Foreign Correspondents. During the year which has just elapsed, 1 Foreign Member and 1 Foreign Correspondent died.

These vacancies were partly filled during 1892 by the election of 1 Foreign Member and 3 Foreign Correspondents, but there was still 1 vacancy in the list of Foreign Members at the end of the year.

With regard to the Society's Income and Expenditure in 1892, they may be briefly summarized as follows:—

The total Receipts on account of Income amounted to £2927 14*s.* 9*d.*, being £234 12*s.* 5*d.* more than the estimated Income for 1892. On the other hand, the Expenditure during that year (leaving out of account the sum of £528 3*s.* expended in the purchase of £400 London and South Western Railway 4°/₀ Preference Stock) amounted to £2358 11*s.* 3*d.*, being £263 15*s.* 9*d.* less than the estimated Expenditure for 1892. The actual excess of Receipts over current Expenditure amounted to £569 3*s.* 6*d.*

In recording this extremely satisfactory result, it should be mentioned that some portion, at least, of the excess of Receipts is accounted for by the successful claim and recovery from the Inland Revenue of a sum of £96 9*s.* 8*d.*, representing four years' taxes under Schedules A and C (viz. £54 and £42 9*s.* 8*d.* respectively). It is, moreover, anticipated that in future years a saving of about £13 and £11 per annum respectively will be effected under those headings. Of the sum reimbursed to the Society, £16 10*s.* 1*d.* belongs to the various Trust Accounts, and these have been duly credited with the corresponding amounts.

The Council have pleasure in announcing the completion of Volume XLVIII. and the commencement of Volume XLIX. of the Society's Journal.

The following awards of Medals and Memorial Funds have been made by the Council:—

The Wollaston Medal is awarded to Prof. Nevil Story Maskelyne, M.A., F.R.S., in recognition of his eminent services in those branches of geological science in which Wollaston himself was especially proficient; and further, in token of appreciation of his valuable additions to our knowledge of the mineral constitution of meteorites.

The Murchison Medal, with a sum of Twenty Guineas from the Proceeds of the Fund, is awarded to the Rev. Osmond Fisher, M.A., F.G.S., in recognition of his valuable and long-continued researches in the stratigraphical geology of the Eastern Counties and the South-east of England, and more especially his admirable contributions to the physical history of the earth's crust.

The Lyell Medal, with a sum of Twenty-five Pounds from the Proceeds of the Fund, is awarded to Mr. E. Tulley Newton, F.G.S., as a token of appreciation of his important and fruitful researches in various branches of palæontology.

The Bigsby Medal is awarded to Prof. W. J. Sollas, D.Sc., F.R.S.,

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in testimony of appreciation of his valuable and varied contributions to many departments of geological science.

The Balance of the Proceeds of the Wollaston Donation Fund is awarded to Mr. J. G. Goodchild, F.G.S., in recognition of his geological researches in the North-west of England, and of his untiring efforts in the promotion of the science generally.

The Balance of the Proceeds of the Murchison Geological Fund is awarded to Mr. G. J. Williams, F.G.S., as a token of appreciation of his laborious researches among the rocks of North Wales, and to aid him in his future investigations.

One moiety of the Balance of the Proceeds of the Lyell Geological Fund is awarded to Miss C. A. Raisin, B.Sc., in recognition of her researches in petrology and other branches of geological science.

The other moiety of the Balance of the Proceeds of the Lyell Geological Fund is awarded to Mr. Alfred N. Leeds, in appreciation of his long-continued and successful endeavours to collect and reconstitute the Fossil Vertebrata of the Oxford Clay of the neighbourhood of Peterborough.

Report of the Library and Museum Committee for 1892.

Library.

During the year which has elapsed since the presentation of your Committee's previous report, the Library has acquired, partly through the kindness of various donors and partly by purchase, a large number of valuable works and serials.

Turning first of all to the Donations, we find that the Library has received about 84 Volumes of separately published works and Survey Reports, and 235 Pamphlets, besides about 117 Volumes and 50 detached Parts of the publications of various Societies. Moreover, 16 Volumes of Newspapers have been received. The total addition, by gift, to the Society's Library is therefore about 217 Volumes and 235 Pamphlets.

By donation also the Library has received 18 sheets of Maps.

The Books and Maps which have just been enumerated were the gift of 96 Personal Donors, of the Editors or Publishers of 21 Periodicals, of 88 Societies, and of 25 Surveys and other Public Bodies—in all, 230 Donors.

By Purchase, on the recommendation of the Standing Library and Museum Committee, the following additions have been made to the Library :—41 Volumes of separately published works, and 95 Volumes and 33 Parts of works published serially.

The cost of Books and Periodicals purchased during the year 1892 was £116 1*s.* 11*d.*, and the cost of Binding amounted to £81 14*s.* 11*d.*, making a total expenditure on the Library of £197 16*s.* 10*d.*

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The work of making good the deficiencies existing in many sets of scientific serials in the Society's Library has further progressed during the past twelvemonth, 22 sets previously imperfect having now been completed. Worthy, perhaps, of particular mention among these are the 'Comptes Rendus de l'Académie des Sciences' and the 'Bulletins et Mémoires de la Société Géologique de France.'

As the result of an application made by the Assistant Secretary to the Netherlands Minister for the Colonies, 25 volumes of the 'Jaarboek van het Mijnwezen in Nederlandsch Oost-Indië,' which in the course of the past seventeen years had been sent by the Dutch Government to the Foreign Office (for transmission, it is believed, to this Society), but had been retained in error and distributed among various Government departments, were collected by the Foreign Office and handed over to this Society's Library.

The Society's collection of historically interesting mementoes of the earlier generation of illustrious geologists has been enriched during the past year by the gift of a bust of Sir Charles Lyell, and a reproduction of a portrait in crayons of Leonard Horner, from Mrs. Catherine Lyell; a copy of Macculloch's Geological Map of Scotland, from Professor Judd, F.R.S.; and a framed portrait of Dr. Samuel P. Woodward, from H. B. Woodward, Esq. An early portrait in oils of Sir Charles Lyell, believed to have been painted about the year 1832, was purchased at a cost of £1.

Such of the six-inch Ordnance Survey Maps as are in the Society's possession have now all been placed in suitable cases.

Museum.

No additions have been made to the collections during the past year. The work of labelling in a distinctive manner and registering the type-specimens, unfortunately interrupted during several months by the serious illness of Mr. C. Davies Sherborn, was actively resumed by him on his recovery. He has now gone through nearly 26 Cabinets or 523 Drawers of specimens.

The total expenditure on the Museum in the year 1892 amounts to £20 5*s.* 6*d.*, and includes the following items:—

	£	*s.*	*d.*
Special work at the Museum	20	0	0
Sundries	0	5	6
	£20	5	6

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COMPARATIVE STATEMENT OF THE NUMBER OF THE SOCIETY AT THE CLOSE OF THE YEARS 1891 AND 1892.

	Dec. 31, 1891.	Dec. 31, 1892.
Compounders	312	311
Contributing Fellows	904	896
Non-contributing Fellows	124	114
	1340	1321
Foreign Members	39	39
Foreign Correspondents	39	40
	1418	1400

Comparative Statement explanatory of the Alterations in the Number of Fellows, Foreign Members, and Foreign Correspondents at the close of the years 1891 *and* 1892.

Number of Compounders, Contributing and Non-contributing Fellows, 31st December, 1891		1340
Add Fellows elected during former year and paid in 1892		18
Add Fellows elected and paid in 1892		33
		1391
Deduct Compounders deceased	6	
Contributing Fellows deceased	24	
Non-contributing Fellows deceased	8	
Contributing Fellows resigned	15	
Compounder removed	1	
Contributing Fellows removed	14	
Non-contributing Fellows removed	2	
	—	70
		1321
Number of Foreign Members and Foreign Correspondents, 31st December, 1891	78	
Deduct Foreign Member deceased	1	
Foreign Correspondent deceased	1	
Foreign Correspondent elected Foreign Member	1	
	— 3	
	75	
Add Foreign Member elected	1	
Foreign Correspondents elected	3	
	—	79
		1400

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Deceased Fellows.

Compounders (6).

Allen, E., Esq.
Burnand, G., Esq.
Freeland, H. W., Esq.
Gervis, Dr. W. S.
Owen, Sir R.
Spence, J. B., Esq.

Resident and other Contributing Fellows (24).

Abbott, Rev. A. R.
Betley, R., Esq.
Bevington, J. B., Esq.
Brunlees, Sir J.
Dairon, J., Esq.
Davies, T., Esq.
De Laune, C. De L. F., Esq.
Dover, W. K., Esq.
Fawkes, Major F. H.
Floyd, T., Esq.
Glen, D. C., Esq.
Guest, Rev. W.
Harrison, J. T., Esq.
Hart, T., Esq.
Homersham, C., Esq.
Lindon, E. B., Esq.
Marten, H. J., Esq.
Murray, J., Esq.
Norton, H., Esq.
Peace, M. W., Esq.
Roberts, T., Esq.
Talman, J. J., Esq.
Tate, A. N., Esq.
Woolcock, H., Esq.

Non-contributing Fellows (8).

Bright, Dr. J.
Clay, J. T., Esq.
Dillwyn, L. L., Esq.
Hargreaves, E. H., Esq.
Henry, Dr. W. C.
Hunt, R., Esq.
Reed, W., Esq.
Wynne, T., Esq.

Foreign Member (1).

Newberry, Dr. J. S.

Foreign Correspondent (1).

Zigno, Baron A. de.

Fellows Resigned (15).

Blows, S., Esq.
Brunton, J., Esq.
Cowham, J. H., Esq.
Dysart, Earl.
Edridge-Green, Dr. F. W.
Gardner, J. S., Esq.
Giles, G. F. L., Esq.
Lemon, W. G., Esq.
Loveday, W. T., Esq.
Noble, T. S., Esq.
Pattison, S. R., Esq.
Rose, Rev. A.
Spalding, H. A., Esq.
Thuey, A., Esq.
Wood, W. H., Esq.

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FELLOWS REMOVED (17).

Boyd, R. N., Esq.	Lane, C., Esq.
Crawford, J. S., Esq.	Martin, J., Esq.
*Earle, C., Esq.	*Meyer, C. P., Esq.
Easton, E., Esq.	Mirza Mehdy Khan.
*Elwin, H., Esq.	Seaver, J. C. B. P., Esq.
Ffolkes, M. W. B., Esq.	Simons, A., Esq.
Glenny, H., Esq.	Stirling, J., Esq.
Gordon, D. G. H., Esq.	Stopes, H., Esq.
James, Rev. G. W.	

* Removed from list after having remained thereon for many years without any known address.

The following Personage was elected from the List of Foreign Correspondents to fill the vacancy in the List of Foreign Members during the year 1892.

Professor Gustav Lindström, of Stockholm.

The following Personages were elected Foreign Correspondents during the year 1892.

Professor Johann Lehmann, of Kiel.
Major John W. Powell, of Washington, D.C., U.S.A.
Professor George H. Williams, of Baltimore, U.S.A.

After the Reports had been read, it was resolved:—

That they be received and entered on the Minutes of the Meeting, and that such parts of them as the Council shall think fit be printed and circulated among the Fellows.

It was afterwards resolved:—

That the thanks of the Society be given to Prof. T. G. Bonney and L. Fletcher, Esq., retiring from the office of Vice-Presidents.

That the thanks of the Society be given to Dr. H. Hicks, retiring from the office of Secretary.

That the thanks of the Society be given to J. W. Davis, Esq., L. Fletcher, Esq., Prof. C. Le Neve Foster, Prof. T. McKenny Hughes, and W. Topley, Esq., retiring from the Council.

After the Balloting-glasses had been duly closed, and the Lists examined by the Scrutineers, the following gentlemen were declared to have been duly elected as the Officers and Council for the ensuing year:—

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OFFICERS.

PRESIDENT.

W. H. Hudleston, Esq., M.A., F.R.S., F.L.S.

VICE-PRESIDENTS.

Sir Archibald Geikie, D.Sc., LL.D., For. Sec. R.S.
G. J. Hinde, Ph.D.
Prof. J. W. Judd, F.R.S.
Henry Woodward, LL.D., F.R.S.

SECRETARIES.

J. E. Marr, Esq., M.A., F.R.S.
J. J. H. Teall, Esq., M.A., F.R.S.

FOREIGN SECRETARY.

J. W. Hulke, Esq., F.R.S.

TREASURER.

Prof. T. Wiltshire, M.A., F.L.S.

COUNCIL.

Prof. J. F. Blake, M.A.
Prof. T. G. Bonney, D.Sc., LL.D., F.R.S.
R. Etheridge, Esq., F.R.S.
Sir Archibald Geikie, D.Sc., LL.D., For. Sec. R.S.
Prof. A. H. Green, M.A., F.R.S.
Alfred Harker, Esq., M.A.
H. Hicks, M.D., F.R.S.
G. J. Hinde, Ph.D.
T. V. Holmes, Esq.
W. H. Hudleston, Esq., M.A., F.R.S., F.L.S.
J. W. Hulke, Esq., F.R.S.
Prof. J. W. Judd, F.R.S.
R. Lydekker, Esq., B.A.
Lieut.-General C. A. McMahon.
J. E. Marr, Esq., M.A., F.R.S.
H. W. Monckton, Esq., F.L.S.
Clement Reid, Esq., F.L.S.
F. Rutley, Esq.
J. J. H. Teall, Esq., M.A., F.R.S.
Prof. T. Wiltshire, M.A., F.L.S.
Rev. H. H. Winwood, M.A.
Henry Woodward, LL.D., F.R.S.
H. B. Woodward, Esq.

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LIST OF

THE FOREIGN MEMBERS

OF THE GEOLOGICAL SOCIETY OF LONDON, IN 1892.

Date of Election.	
1848.	James Hall, Esq., *Albany, State of New York, U.S.A.*
1851.	Professor James D. Dana, *New Haven, Connecticut, U.S.A.*
1853.	Count Alexander von Keyserling, *Rayküll, Russia.*
1856.	Professor Robert Bunsen, For. Mem. R.S., *Heidelberg.*
1857.	Professor H. B. Geinitz, *Dresden.*
1867.	Professor A. Daubrée, For. Mem. R.S., *Paris.*
1871.	Dr. Franz Ritter von Hauer, *Vienna.*
1874.	Professor Albert Gaudry, *Paris.*
1875.	Professor Fridolin Sandberger, *Würzburg.*
1876.	Professor E. Beyrich, *Berlin.*
1877.	Dr. Carl Wilhelm Gümbel, *Munich.*
1877.	Dr. Eduard Suess, *Vienna.*
1879.	Major-General N. von Kokscharow, *St. Petersburg.* (*Deceased.*)
1879.	M. Jules Marcou, *Cambridge, U.S.A.*
1879.	Dr. J. J. S. Steenstrup, For. Mem. R.S., *Copenhagen.*
1880.	Professor Gustave Dewalque, *Liége.*
1880.	Baron Adolf Erik Nordenskiöld, *Stockholm.*
1880.	Professor Ferdinand Zirkel, *Leipzig.*
1882.	Professor Sven Lovén, *Stockholm.*
1882.	Professor Ludwig Rütimeyer, *Basel.*
1883.	Professor J. S. Newberry, *New York, U.S.A.* (*Deceased.*)
1883.	Professor Otto Martin Torell, *Stockholm.*
1884.	Professor G. Capellini, *Bologna.*
1884.	Professor A. L. O. Des Cloizeaux, For. Mem. R.S., *Paris.*
1884.	Professor J. Szabó, *Pesth.*
1885.	Professor Jules Gosselet, *Lille.*
1886.	Professor Gustav Tschermak, *Vienna.*
1887.	Professor J. P. Lesley, *Philadelphia, U.S.A.*
1887.	Professor J. D. Whitney, *Cambridge, U.S.A.*
1888.	Professor Pierre J. van Beneden, *Louvain.*
1888.	Professor Eugène Renevier, *Lausanne.*
1888.	Baron Ferdinand von Richthofen, *Berlin.*
1889.	Professor Ferdinand Fouqué, *Paris.*
1889.	Marquis Gaston de Saporta, *Aix-en-Provence.*
1889.	Professor Karl Alfred von Zittel, *Munich.*
1890.	Professor Heinrich Rosenbusch, *Heidelberg.*
1890.	Herr Dionys Stur, *Vienna.*
1891.	Dr. Charles Barrois, *Lille.*
1891.	M. Gustave H. Cotteau, *Auxerre.*
1892.	Professor Gustav Lindström, *Stockholm.*

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LIST OF

THE FOREIGN CORRESPONDENTS

OF THE GEOLOGICAL SOCIETY OF LONDON, IN 1892.

Date of Election.	
1863.	Dr. F. Senft, *Eisenach.*
1866.	Professor Victor Raulin, *Montfaucon d'Argonne.*
1866.	Baron Achille de Zigno, *Padua.* (*Deceased.*)
1874.	Professor Igino Cocchi, *Florence.*
1874.	Dr. T. C. Winkler, *Haarlem.*
1877.	Professor George J. Brush, *New Haven, U.S.A.*
1879.	M. Édouard Dupont, *Brussels.*
1879.	Dr. Émile Sauvage, *Boulogne-sur-Mer.*
1880.	Professor Alphonse Renard, *Ghent.*
1881.	Professor E. D. Cope, *Philadelphia, U.S.A.*
1882.	Professor Louis Lartet, *Toulouse.*
1882.	Professor Alphonse Milne-Edwards, *Paris.*
1884.	M. Alphonse Briart, *Morlanwelz.*
1884.	Professor Hermann Credner, *Leipzig.*
1884.	Baron C. von Ettingshausen, *Grätz.*
1884.	Dr. E. Mojsisovics von Mojsvár, *Vienna.*
1885.	Dr. A. G. Nathorst, *Stockholm.*
1886.	Professor J. Vilanova y Piera, *Madrid.*
1887.	Senhor J. F. N. Delgado, *Lisbon.*
1887.	Professor A. Heim, *Zürich.*
1887.	Professor A. de Lapparent, *Paris.*
1888.	Professor W. C. Brögger, *Christiania.*
1888.	M. Charles Brongniart, *Paris.*
1888.	Professor Edward Salisbury Dana, *New Haven, U.S.A.*
1888.	Professor Anton Fritsch, *Prague.*
1888.	M. Ernest Van den Broeck, *Brussels.*
1889.	Professor G. K. Gilbert, *Washington, U.S.A.*
1889.	M. A. Michel-Lévy, *Paris.*
1889.	Dr. Hans Reusch, *Christiania.*
1889.	M. R. D. M. Verbeek, *Padang, Sumatra.*
1890.	M. Gustave F. Dollfus, *Paris.*
1890.	Herr Felix Karrer, *Vienna.*
1890.	Professor Adolph von Könen, *Göttingen.*
1890.	M. Friedrich Schmidt, *St. Petersburg.*
1891.	Señor Don Antonio del Castillo, *Mexico.*
1891.	Professor W. Dames, *Berlin.*
1891.	Professor Emanuel Kayser, *Marburg.*
1891.	Professor Karl August Lossen, *Berlin.* (*Deceased.*)
1892.	Professor Johann Lehmann, *Kiel.*
1892.	Major John W. Powell, *Washington, D.C., U.S.A.*
1892.	Professor George H. Williams, *Baltimore, U.S.A.*

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AWARDS OF THE WOLLASTON MEDAL

UNDER THE CONDITIONS OF THE "DONATION FUND"

ESTABLISHED BY

WILLIAM HYDE WOLLASTON, M.D., F.R.S., F.G.S., &c.

"To promote researches concerning the mineral structure of the earth, and to enable the Council of the Geological Society to reward those individuals of any country by whom such researches may hereafter be made,"—"such individual not being a Member of the Council."

1831. Mr. William Smith.
1835. Dr. G. A. Mantell.
1836. M. Louis Agassiz.
1837. Capt. T. P. Cautley. Dr. H. Falconer.
1838. Sir Richard Owen.
1839. Professor C. G. Ehrenberg.
1840. Professor A. H. Dumont.
1841. M. Adolphe T. Brongniart.
1842. Baron L. von Buch.
1843. M. Élie de Beaumont. M. P. A. Dufrénoy.
1844. Rev. W. D. Conybeare.
1845. Professor John Phillips.
1846. Mr. William Lonsdale.
1847. Dr. Ami Boué.
1848. Rev. Dr. W. Buckland.
1849. Professor Joseph Prestwich.
1850. Mr. William Hopkins.
1851. Rev. Prof. A. Sedgwick.
1852. Dr. W. H. Fitton.
1853. M. le Vicomte A. d'Archiac. M. E. de Verneuil.
1854. Sir Richard Griffith.
1855. Sir H. T. De la Beche.
1856. Sir W. E. Logan.
1857. M. Joachim Barrande.
1858. Herr Hermann von Meyer. Mr. James Hall.
1859. Mr. Charles Darwin.
1860. Mr. Searles V. Wood.
1861. Professor Dr. H. G. Bronn.
1862. Mr. R. A. C. Godwin-Austen.
1863. Professor Gustav Bischof.
1864. Sir R. I. Murchison.
1865. Dr. Thomas Davidson.
1866. Sir Charles Lyell.
1867. Mr. G. Poulett Scrope.
1868. Professor Carl F. Naumann.
1869. Dr. H. C. Sorby.
1870. Professor G. P. Deshayes.
1871. Sir A. C. Ramsay.
1872. Professor J. D. Dana.
1873. Sir P. de M. Grey-Egerton.
1874. Professor Oswald Heer.
1875. Professor L. G. de Koninck.
1876. Professor T. H. Huxley.
1877. Mr. Robert Mallet.
1878. Dr. Thomas Wright.
1879. Professor Bernhard Studer.
1880. Professor Auguste Daubrée.
1881. Professor P. Martin Duncan.
1882. Dr. Franz Ritter von Hauer.
1883. Dr. W. T. Blanford.
1884. Professor Albert Gaudry.
1885. Mr. George Busk.
1886. Professor A. L. O. Des Cloizeaux.
1887. Mr. J. Whitaker Hulke.
1888. Mr. H. B. Medlicott.
1889. Professor T. G. Bonney.
1890. Professor W. C. Williamson.
1891. Professor J. W. Judd.
1892. Baron Ferdinand von Richthofen.
1893. Professor N. S. Maskelyne.

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AWARDS

OF THE

BALANCE OF THE PROCEEDS OF THE WOLLASTON "DONATION FUND."

1831. Mr. William Smith.
1833. Mr. William Lonsdale.
1834. M. Louis Agassiz.
1835. Dr. G. A. Mantell.
1836. Professor G. P. Deshayes.
1838. Sir Richard Owen.
1839. Professor C. G. Ehrenberg.
1840. Mr. J. De Carle Sowerby.
1841. Professor Edward Forbes.
1842. Professor John Morris.
1843. Professor John Morris.
1844. Mr. William Lonsdale.
1845. Mr. Geddes Bain.
1846. Mr. William Lonsdale.
1847. M. Alcide d'Orbigny.
1848. { Cape-of-Good-Hope Fossils. / M. Alcide d'Orbigny.
1849. Mr. William Lonsdale.
1850. Professor John Morris.
1851. M. Joachim Barrande.
1852. Professor John Morris.
1853. Professor L. G. de Koninck.
1854. Dr. S. P. Woodward.
1855. Drs. G. and F. Sandberger.
1856. Professor G. P. Deshayes.
1857. Dr. S. P. Woodward.
1858. Mr. James Hall.
1859. Mr. Charles Peach.
1860. { Professor T. Rupert Jones. / Mr. W. K. Parker.
1861. Professor A. Daubrée.
1862. Professor Oswald Heer.
1863. Professor Ferdinand Senft.
1864. Professor G. P. Deshayes.
1865. Mr. J. W. Salter.
1866. Dr. Henry Woodward.
1867. Mr. W. H. Baily.
1868. M. J. Bosquet.
1869. Mr. W. Carruthers.
1870. M. Marie Rouault.
1871. Mr. R. Etheridge.
1872. Dr. James Croll.
1873. Professor J. W. Judd.
1874. Dr. Henri Nyst.
1875. Mr. L. C. Miall.
1876. Professor Giuseppe Seguenza.
1877. Mr. R. Etheridge, Jun.
1878. Professor W. J. Sollas.
1879. Mr. S. Allport.
1880. Mr. Thomas Davies.
1881. Dr. R. H. Traquair.
1882. Dr. G. J. Hinde.
1883. Mr. John Milne.
1884. Mr. E. Tulley Newton.
1885. Dr. Charles Callaway.
1886. Mr. J. S. Gardner.
1887. Mr. B. N. Peach.
1888. Mr. J. Horne.
1889. Mr. A. Smith Woodward.
1890. Mr. W. A. E. Ussher.
1891. Mr. R. Lydekker.
1892. Mr. O. A. Derby.
1893. Mr. J. G. Goodchild.

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AWARDS OF THE MURCHISON MEDAL

AND OF THE

PROCEEDS OF THE "MURCHISON GEOLOGICAL FUND,"

ESTABLISHED UNDER THE WILL OF THE LATE

SIR RODERICK IMPEY MURCHISON, BART., F.R.S., F.G.S.

"To be applied in every consecutive year in such manner as the Council of the Society may deem most useful in advancing geological science, whether by granting sums of money to travellers in pursuit of knowledge, to authors of memoirs, or to persons actually employed in any inquiries bearing upon the science of geology, or in rewarding any such travellers, authors, or other persons, and the Medal to be given to some person to whom such Council shall grant any sum of money or recompense in respect of geological science."

1873. Mr. William Davies. *Medal.*
1873. Professor Oswald Heer.
1874. Dr. J. J. Bigsby. *Medal.*
1874. Mr. Alfred Bell.
1874. Professor Ralph Tate.
1875. Mr. W. J. Henwood. *Medal.*
1875. Professor H. G. Seeley.
1876. Mr. A. R. C. Selwyn. *Medal.*
1876. Dr. James Croll.
1877. Rev. W. B. Clarke. *Medal.*
1877. Professor J. F. Blake.
1878. Dr. H. B. Geinitz. *Medal.*
1878. Professor Charles Lapworth.
1879. Professor F. M'Coy. *Medal.*
1879. Mr. J. W. Kirkby.
1880. Mr. R. Etheridge. *Medal.*
1881. Professor A. Geikie. *Medal.*
1881. Mr. F. Rutley.
1882. Professor J. Gosselet. *Medal.*
1882. Professor T. Rupert Jones.
1883. Professor H. R. Göppert. *Medal.*
1883. Mr. John Young.
1884. Dr. H. Woodward. *Medal.*
1884. Mr. Martin Simpson.
1885. Dr. Ferdinand von Römer. *Medal.*
1885. Mr. Horace B. Woodward.
1886. Mr. W. Whitaker. *Medal.*
1886. Mr. Clement Reid.
1887. Rev. P. B. Brodie. *Medal.*
1887. Mr. Robert Kidston.
1888. Professor J. S. Newberry. *Medal.*
1888. Mr. E. Wilson.
1889. Professor James Geikie. *Medal.*
1889. Mr. Grenville A. J. Cole.
1890. Professor Edward Hull. *Medal.*
1890. Mr. E. Wethered.
1891. Professor W. C. Brögger. *Medal.*
1891. Rev. R. Baron.
1892. Professor A. H. Green. *Medal.*
1892. Mr. Beeby Thompson.
1893. Rev. O. Fisher. *Medal.*
1893. Mr. G. J. Williams.

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AWARDS OF THE LYELL MEDAL

AND OF THE

PROCEEDS OF THE "LYELL GEOLOGICAL FUND,"

ESTABLISHED UNDER THE WILL AND CODICIL OF THE LATE SIR CHARLES LYELL, Bart., F.R.S., F.G.S.

The Medal "to be given annually" (or from time to time) "as a mark of honorary distinction and as an expression on the part of the governing body of the Society that the Medallist (who may be of any country or either sex) has deserved well of the Science,"—"not less than one third of the annual interest [of the fund] to accompany the Medal, the remaining interest to be given in one or more portions at the discretion of the Council for the encouragement of Geology or of any of the allied sciences by which they shall consider Geology to have been most materially advanced, either for travelling expenses or for a memoir or paper published, or in progress, and without reference to the sex or nationality of the author, or the language in which any such memoir or paper may be written."

1876. Professor John Morris. *Medal.*
1877. Dr. James Hector. *Medal.*
1877. Mr. W. Pengelly.
1878. Mr. G. Busk. *Medal.*
1878. Dr. W. Waagen.
1879. Professor Edmond Hébert. *Medal.*
1879. Professor H. A. Nicholson.
1879. Dr. Henry Woodward.
1880. Mr. John Evans. *Medal.*
1880. Professor F. A. von Quenstedt.
1881. Sir J. W. Dawson. *Medal.*
1881. Dr. Anton Fritsch.
1881. Mr. G. R. Vine.
1882. Dr. J. Lycett. *Medal.*
1882. Rev. Norman Glass.
1882. Professor Charles Lapworth.
1883. Dr. W. B. Carpenter. *Medal.*
1883. Mr. P. H. Carpenter.
1883. M. E. Rigaux.
1884. Dr. Joseph Leidy. *Medal.*
1884. Professor Charles Lapworth.
1885. Professor H. G. Seeley. *Medal.*
1885. Mr. A. J. Jukes-Browne.
1886. Mr. W. Pengelly. *Medal.*
1886. Mr. D. Mackintosh.
1887. Mr. Samuel Allport. *Medal.*
1887. Rev. Osmond Fisher.
1888. Professor H. A. Nicholson. *Medal.*
1888. Mr. A. H. Foord.
1888. Mr. T. Roberts.
1889. Professor W. Boyd Dawkins. *Medal.*
1889. M. Louis Dollo.
1890. Professor T. Rupert Jones. *Medal.*
1890. Mr. C. Davies Sherborn.
1891. Professor T. M'Kenny Hughes. *Medal.*
1891. Dr. C. J. Forsyth-Major.
1891. Mr. G. W. Lamplugh.
1892. Mr. G. H. Morton. *Medal.*
1892. Mr. J. W. Gregory.
1892. Mr. E. A. Walford.
1893. Mr. E. T. Newton. *Medal.*
1893. Miss C. A. Raisin.
1893. Mr. A. N. Leeds.

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AWARDS OF THE BIGSBY MEDAL,

FOUNDED BY THE LATE

DR. J. J. BIGSBY, F.R.S., F.G.S.

To be awarded biennially "as an acknowledgment of eminent services in any department of Geology, irrespective of the receiver's country; but he must not be older than 45 years at his last birthday, thus probably not too old for further work, and not too young to have done much."

1877. Professor O. C. Marsh.
1879. Professor E. D. Cope.
1881. Dr. C. Barrois.
1883. Dr. Henry Hicks.
1885. Professor Alphonse Renard.
1887. Professor Charles Lapworth.
1889. Mr. J. J. Harris Teall.
1891. Dr. G. M. Dawson.
1893. Professor W. J. Sollas.

AWARDS OF THE PROCEEDS OF THE BARLOW-JAMESON FUND,

ESTABLISHED UNDER THE WILL OF THE LATE

DR. H. C. BARLOW, F.G.S.

"The perpetual interest to be applied every two or three years, as may be approved by the Council, to or for the advancement of Geological Science."

1880. Purchase of microscope.
1881. Purchase of microscope lamps.
1882. Baron C. von Ettingshausen.
1884. Dr. James Croll.
1884. Professor Leo Lesquereux.
1886. Dr. H. J. Johnston-Lavis.
1888. Museum.
1890. Mr. W. Jerome Harrison.
1892. Professor Charles Mayer-Eymar.

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ESTIMATES *for*

INCOME EXPECTED.

	£	s.	d.	£	s.	d.
Compositions				105	0	0
Due for Arrears of Admission-fees	25	4	0			
Admission-fees, 1893	157	10	0			
				182	14	0
Due for Arrears of Annual Contributions				63	0	0
Annual Contributions, 1893, from Resident Fellows, and Non-residents, 1859 to 1861				1680	0	0
Annual Contributions in advance				35	0	0
Dividends on Consolidated 2¾ per Cents.				101	1	4
Dividends on London and North-Western Railway 4 per cent. Consolidated Preference Stock				87	15	0
Dividends on London and South-Western Railway 4 per cent. Consolidated Preference Stock				109	4	0
Sale of Quarterly Journal, including Longman's account	165	0	0			
Sale of Geological Map, including Stanford's account	12	0	0			
Sale of Transactions, Library-catalogue, Ormerod's Index, Hochstetter's 'New Zealand,' and List of Fellows	5	0	0			
				182	0	0

£2545 14 4

THOMAS WILTSHIRE, TREASURER.

28*th January*, 1893.

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the Year 1893.

EXPENDITURE ESTIMATED.

	£	s.	d.	£	s.	d.
House Expenditure:						
Taxes	4	4	6			
Fire-insurance	15	0	0			
Gas	35	0	0			
Fuel	30	0	0			
Furniture and Repairs	30	0	0			
House-repairs and Maintenance	35	0	0			
Annual Cleaning	15	0	0			
Washing and Sundries	25	0	0			
Tea at Meetings	14	0	0			
				203	4	6
Salaries and Wages, &c.:						
Assistant Secretary	250	0	0			
„ Half premium of Life Insurance	10	15	0			
Assistant Librarian and Assistant Clerk	270	0	0			
House Porter and Upper-Housemaid, including Uniform and Allowance for Washing	91	12	0			
Under-Housemaid, including Allowance for Washing	42	12	0			
Errand Boy	23	8	0			
Charwoman and Occasional Assistance	16	0	0			
Accountant's Fee	10	10	0			
				714	17	0
Official Expenditure:						
Stationery	25	0	0			
Miscellaneous Printing	30	0	0			
Postages and other Expenses	90	0	0			
				145	0	0
Library (Books and Binding)				200	0	0
Museum				50	0	0
Publications:						
Geological Map	5	0	0			
Quarterly Journal	900	0	0			
„ „ Commission, Postage, and Addressing	100	0	0			
List of Fellows	35	0	0			
Abstracts, including Postage	110	0	0			
				1150	0	0
Balance in favour of the Society				82	12	10
				£2545	14	4

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Income and Expenditure during the

RECEIPTS.

	£	s.	d.	£	s.	d.
Balance in Bankers' hands, 1 January, 1892	264	17	11			
Balance in Clerk's hands, 1 January, 1892	22	1	5			
				286	19	4
Compositions				189	0	0
Arrears of Admission-fees	113	8	0			
Admission-fees, 1892	207	18	0			
				321	6	0
Arrears of Annual Contributions				109	17	2
Annual Contributions for 1892, viz.:						
Resident Fellows	1684	4	0			
Non-Resident Fellows	12	14	6			
				1696	18	6
Annual Contributions in advance				37	16	0
Dividends on $2\frac{3}{4}$ p. c. Consolidated Stock	101	1	4			
,, L. & N. W. Railway Stock	87	15	0			
,, L. & S. W. Railway Stock	97	10	0			
				286	6	4
Taylor & Francis: Advertisements in Journal, Vol. 47				4	4	2
Publications:						
Sale of Journal, Vols. 1–47	109	2	9			
,, Vol. 48 *	76	4	3			
Sale of Library Catalogue	1	10	0			
Sale of Geological Map	12	2	8			
Sale of Ormerod's Index	2	10	10			
Sale of Hochstetter's 'New Zealand'	0	4	0			
Sale of Transactions	0	11	0			
Sale of List of Fellows	0	1	6			
				202	7	0
Repayment of Income Tax under						
Schedule A for four years 1888–92	54	0	0			
Schedule C for four years 1888–92	25	19	7			
				79	19	7
*Due from Messrs. Longmans, in addition to the above, on Journal, Vol. 48, &c.	65	12	10			
Due from Stanford on account of Geological Map	12	1	3			

We have compared this statement with the Books and Accounts presented to us, and find them to agree.

(Signed) T. V. HOLMES,
HORACE W. MONCKTON, } *Auditors.*

28th January, 1893.

£3214 14 1

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Year ending 31st December, 1892.

EXPENDITURE.

	£	s.	d.	£	s.	d.
House Expenditure:						
Taxes	18	5	0			
Fire-insurance	15	0	0			
Gas	34	2	0			
Fuel	28	0	10			
Furniture and Repairs	52	4	2			
House-repairs	35	5	3			
Annual Cleaning	15	7	2			
Washing and Sundries	24	10	0			
Tea at Meetings	13	12	0			
				236	6	5
Salaries and Wages, &c.:						
Assistant Secretary	250	0	0			
„ Half premium of Life Insurance	10	15	0			
Assistant Librarian and Assistant Clerk	260	0	0			
House Porter and Upper-Housemaid, including Uniform and Allowance for Washing	93	19	5			
Under-Housemaid, including Allowance for Washing	43	17	3			
Errand Boy	18	10	0			
Charwoman and Occasional Assistance	15	11	4			
Accountant's Fee	10	10	0			
Late House-Steward (three months' pension)	17	10	0			
				720	13	0
Official Expenditure:						
Stationery	21	4	5			
Miscellaneous Printing	28	14	7			
Postages and other Expenses	86	12	6			
				136	11	6
Library (Books and Binding)				197	16	10
Museum				20	5	6
Publications:						
Geological Map		4	3 10			
Journal, Vols. 1–47		10	1 1			
„ Vol. 48	805	1	11			
„ „ Commission, Postage, and Addressing	86	4	10			
		891	6 9			
List of Fellows		35	1 1			
Abstracts, including Postage		105	1 6			
Ormerod's Index		1	3 9			
				1046	18	0
Investment in £200 L. & S. W. Railway 4 per cent. Consolidated Pref. Stock, @ 128¼	259	6	0			
Investment in £200 L. & S. W. Railway 4 per cent. Consolidated Pref. Stock, @ 133	268	17	0			
				528	3	0
Balance in Bankers' hands, 31 Dec. 1892	311	1	9			
Balance in Clerk's hands, 31 Dec. 1892	16	18	1			
				327	19	10
				£3214	14	1

THOMAS WILTSHIRE, *Treasurer.*

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"Wollaston Donation Fund." Trust Account.

Receipts.	£	s.	d.	Payments.	£	s.	d.
Balance at Bankers', 1 January, 1892	21	16	0	Cost of striking Gold Medal awarded to Baron F. von Richthofen	10	10	0
Dividends on the Fund invested in 2¾ per cent. Consolidated Stock	29	1	4	Award to Mr. O. A. Derby	18	11	4
Repayment of Income Tax under Schedule C for four years 1888–92	3	6	9	Balance at Bankers', 31 December, 1892	25	2	9
	£54	4	1		£54	4	1

"Murchison Geological Fund." Trust Account.

Receipts.	£	s.	d.	Payments.	£	s.	d.
Balance at Bankers', 1 January, 1892	19	10	0	Award to Prof. A. H. Green, with Medal	10	10	0
Dividends on the Fund invested in London and North-Western Railway 4 per cent. Debenture Stock	39	0	0	„ Mr. B. Thompson	27	13	0
Repayment of Income Tax under Schedule C for four years 1888–92	4	0	10	Cost of Medal	0	17	0
				Balance at Bankers', 31 December, 1892	23	10	10
	£62	10	10		£62	10	10

"Lyell Geological Fund." Trust Account.

Receipts.	£	s.	d.	Payments.	£	s.	d.
Balance at Bankers', 1 January, 1892	51	9	0	Award to Mr. G. H. Morton, with Medal	25	0	0
Dividends on the Fund invested in Metropolitan 3½ per cent. Stock	68	12	0	„ Mr. J. W. Gregory	21	5	6
Repayment of Income Tax under Schedule C for four years 1888–92	7	1	6	„ Mr. E. A. Walford	21	5	6
				Cost of Medal	1	1	0
				Balance at Bankers', 31 December, 1892	58	10	6
	£127	2	6		£127	2	6

"Barlow-Jameson Fund." Trust Account.

Receipts.	£	s.	d.	Payments.	£	s.	d.
Balance at Bankers', 1 January, 1892	44	13	10	Award to Prof. C. Mayer-Eymar	21	0	0
Dividends on the Fund invested in 2¾ per cent. Consolidated Stock	13	8	4	Balance at Bankers', 31 December, 1892	38	10	3
Repayment of Income Tax under Schedule C for four years 1888–92	1	8	1				
	£59	10	3		£59	10	3

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"Bigsby Fund." Trust Account.

Receipts.	£	s.	d.
Balance at Bankers', 1 January, 1892	4	4	0
Dividends on the Fund invested in 2¾ per cent. Consolidated Stock	5	12	
Repayment of Income Tax under Schedule C for four years 1888–92	0	12	11
	£10	8	11

Payments.	£	s.	d.
Balance at Bankers', 31 December, 1892	10	8	11
	£10	8	11

Valuation of the Society's Property; 31st December, 1892.

Property.	£	s.	d.	£	s.	d.
Due from Longman & Co., on account of Journal, vol. xlviii. &c.				65	12	10
Due from Stanford, on account of Map				12	1	3
Balance in Bankers' hands, 31 Dec. 1892				311	1	9
Balance in Clerk's hands, 31 Dec. 1892				16	18	1
Funded Property:—						
Consolidated 2¾ per Cents. at 97	3769	2	6	3656	1	0
London & North-Western Railway 4 per cent. Consolidated Pref. Stock at 131.	2250	0	0	2947	10	0
London & South-Western Railway 4 per cent. Consolidated Pref. Stock at 130.	2800	0	0	3640	0	0
Arrears of Admission-fees (considered good)				25	4	0
Arrears of Annual Contributions (considered good)				63	0	0
[*N.B.—The above does not include the value of the Collections, Library, Furniture, and stock of unsold Publications.*]				£10,737	8	11

	£	s.	d.
Balance in favour of the Society	10,737	8	11
	£10,737	8	11

THOMAS WILTSHIRE, *Treasurer.*

28th January, 1893.

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Award of the Wollaston Medal.

In presenting the Wollaston Medal to Prof. Nevil Story Maskelyne, M.A., F.R.S., F.G.S., the President addressed him in the following words :—

Professor Maskelyne,—

The Council of the Geological Society have this year awarded to you the Wollaston Medal, in recognition of your researches in those branches of science which the Founder himself cultivated with so much success. We do not forget that Wollaston invented the reflecting goniometer, and that no one has been more skilful in the use of that instrument than yourself. Thirty years ago you were enabled, in this way, to make an exact determination of the form of the minute crystals of Connellite; and the later discovery of larger crystals of that mineral has only served to confirm the accuracy of your original determination. During the thirty-five years that you have occupied the Chair of Mineralogy at Oxford you have ever insisted on symmetry as being the essential feature of the crystalline systems. Contemporaneously with your professorial duties you devoted twenty-three years of your life to the development of the mineral collections at the British Museum. These collections had for some years previously been without a mineralogist in charge. With the co-operation of the late Mr. Thomas Davies, your apt pupil and assistant, the collection was rearranged; and when you left the Museum to enter Parliament, in 1880, the classification of the entire collection had reached a high pitch of perfection, while the collection itself had been in many respects enriched.

The investigation of extra-telluric bodies has long since attracted your attention, though the want of a chemical laboratory must have been felt by one who had already proved, from his numerous chemical papers, the interest he took in that science. Failing this, you sought to recognize the individual minerals by the aid of the microscope, working on thin sections—a method now universally adopted in the study of terrestrial rocks. In this way, thirty years ago, you were enabled to determine many of the most important ingredients of meteorites, by means of the relation of the axes of optic elasticity to known crystallographic lines. The microscope was further applied to the mechanical separation of the different mineral ingredients of a meteorite, and the existence of such minerals as enstatite and bronzite demonstrated. Your research on the mineral constituents

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of the Busti meteorite will long remain an example to future workers. Further, in conjunction with the late Dr. Flight, you described the minerals of the diamantiferous rock of South Africa, suggesting that an enstatite-rock, at points of contact with carbonaceous shales, was probably the original home of the diamond—an explanation which is now generally accepted.

Although for several years past your energies have found employment in another direction, we may venture to hope that your interest in those branches of science which Wollaston was desirous of promoting is in no wise lessened; and we trust that you may yet achieve results such as shall even further justify the Council in the selection they have made.

Professor MASKELYNE, in reply, said:—

Mr. PRESIDENT,—

In receiving at your hands the Wollaston Medal, I beg to thank the Council for the great honour they confer on me, and you, Sir, for the generous review in which you have sketched my past scientific life. When my first surprise at the Award gave way to other thoughts, the first of them was one of gratification at the Council having this year determined to give the Medal for studies so nearly connected with Wollaston's work, and to furthering which he rendered such distinguished services. To these you have alluded; and, in the kindly view you have taken of my work, I thank you for associating with it the names of some of those to whom I was much indebted in its achievement.

You have alluded, Sir, to the period—nearly a quarter of a century—that I was working at the British Museum as head of the Mineral Department. I am proud of the work done in those years, and it was done, as most good work is done, by few hands—mostly by those of Mr. Thomas Davies and myself. Davies came to me a young man, fresh from the sea, and absolutely innocent of any scientific knowledge. He died a few weeks ago, in many ways an accomplished man—the best judge of a mineral in this country, and an admirable petrologist—a worthy son of William Davies, and a worthy recipient of the Wollaston Fund, which was awarded him some years ago. And, Sir, I have to thank you for naming another of the helpers in my work—Dr. Walter Flight. He, too, is no more; and there died in him one of the finest of laboratory manipulators and a very accomplished chemist.

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But one name I must supply, of a man who more than thirty years ago came to London for a visit, and remained to work in the Museum for some time. I allude to Viktor von Lang, the partner of Joseph Grailich in the splendid work done by the Vienna school of crystallography and physics, and who had already then a European name. That period of my life, in the continual companionship of so finely trained a physicist and crystallographer, was like a second education.

Then, Sir, you have alluded to the little school, if I may call it so, of Crystallography connected with my Chair at Oxford, and to the results of my teaching. The deduction of the laws of morphological and physical symmetry in crystals from the fundamental law of rational indices lay as a germ, though entirely undeveloped, in the Treatise and tracts of my late friend and master in the study of the science, Prof. Miller, of Cambridge. Modern Crystallography has grown from that germ, and if I have helped in promulgating it in England through my lectures, I owe more to the students who attended those lectures than they owe to me in guiding them; for they have always kept high the standard of crystallographic work in their investigations as in their teaching. Among these I must mention my old friend, W. J. Lewis, now Professor at Cambridge; and I need only allude to the remarkable memoirs on 'Thermic Dilatation in Crystals' and on the 'Optical Indicatrix' by the able mathematician who succeeded me at the British Museum, Mr. Fletcher, and to the fine work of his first assistant, Mr. Miers, to justify me in saying that if I have had any merit in directing such men upon their way, it is to their own qualities that the success of that little Oxford school is due. Gladly, if it were possible, would I divide that Medal among those who have so contributed to the winning of it, and retain as my own share the grateful remembrance that you, Sir, and the Council have thought me worthy to receive it, with the features stamped on it of that distinguished Englishman its Founder, the man to whom we owe the instrument—so simple, so accurate, and so indispensable—the reflection-goniometer; the instrument which made it possible for Crystallography to become an exact science.

Finally, in respect to the last part of your observations, I may say that of the many duties imposed on me by my county during the past few years, I am relieved now of one of the weightiest, and shall be able, I trust, to devote much of the leisure of what may be left to me of life to the subjects which were heretofore my chief

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interest; and in cordially thanking you, Mr. President, and the Council for this, the greatest honour you can confer, I may assure you that it will be a great incentive to me still to strive to be worthy of it.

Award of the Wollaston Donation Fund.

The President then handed the Balance of the Proceeds of the Wollaston Fund, awarded to Mr. J. G. Goodchild, F.G.S., to Prof. T. McKenny Hughes, M.A., F.R.S., F.G.S., for transmission to the recipient, addressing him as follows:—

Professor Hughes,—

The Council, in awarding the Balance of the Proceeds of the Wollaston Donation Fund to Mr. Goodchild, have been desirous of expressing their sense of the value of his geological work in the North-west of England, and more especially of his description of the Glacial phenomena of the Eden Valley, as recorded in the Quarterly Journal of the Society. They also recognize his services in aid of Science generally for many years past, as Editor of the Transactions of the Cumberland and Westmoreland Association, and as the Author of many interesting papers on local Geology which have appeared in those Transactions. The Council hope that his appointment in Edinburgh will not prevent him from still carrying on investigations in the field.

Professor Hughes, in reply, said:—

Mr. President,—

I have, as the oldest friend of Mr. Goodchild in this Society, been asked to receive and transmit to him the Proceeds of the Wollaston Fund. I feel more inclined to dilate upon my friend's deserts than upon the kindness of the Council in making the Award to him.

I will try to compromise the matter by saying only that there is no man who will so keenly appreciate this recognition of his work, and no case in which the Society may reckon on a better return for this wholesome stimulus of encouragement.

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Award of the Murchison Medal.

In presenting the Murchison Medal to the Rev. Osmond Fisher, M.A., F.G.S., the President addressed him as follows:—

Mr. Fisher,—

The Council have this year awarded to you the Murchison Medal, together with a sum of Twenty Guineas, in consideration of the work you have done in the general advancement of Geological Science. They recognize the importance of your work, at once as a stratigraphical geologist and as a physicist who has devoted his attention to problems in connexion with the Earth's crust. It is now nearly forty years since your paper on the Purbeck strata of Dorsetshire made its appearance, worked out while you had charge of a parish in Dorchester, your connexion with this part of the world arising from the fact that your father was formerly Vicar of Osmington. During the last 30 or 35 years a very great number of works have emanated from your pen, and have been published either separately or in the Proceedings of our own or of some other Society.

These works attest the wide range of the subjects in which you have taken an interest and the extent of your scientific research. The subjects may be classified under four principal heads:—1. Earth sculpture and its results; 2. The discrimination of the various superficial deposits collectively spoken of as Drifts; 3. Description of the stratigraphy and palæontology of the later Jurassics of Dorsetshire and the Older Tertiaries of the Isle of Wight; 4. Investigations into the conditions of the Earth's crust, and speculations as to the causes of the great operations which take place therein, either observed in action or inferred from their results.

Whether dealing with denudation in Norfolk, with the Brackleham Beds on the coasts of the Channel, or making use of mathematical analysis to determine what must be the resultant form and status of the Earth (on the hypothesis of a certain not improbable combination of forces, brought to bear upon certain possible conditions of the crust), you have given evidence of that philosophic spirit which has ever been your characteristic. And we have also seen how suggestive your work has been, from the large series of similar investigations which have often followed the publication of your results.

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The Rev. Osmond Fisher, in reply, said:—

Mr. President,—

I regard the award of this Medal to me as to some extent a token that my efforts to find a *modus vivendi* between geologists and physicists have been appreciated by the Geological Society. I regret to say that the leading physicists, at least in this country, make no sign at present either of accepting or of rejecting my conclusions; but the important questions at issue seem on the point of receiving recognition from American mathematicians.

It is with peculiar pleasure that I shall treasure the Murchison Medal. I had the honour many years ago of a slight acquaintance with the distinguished Founder of this endowment, and I recollect still how, at the reading of the first paper which I offered to this Society, Sir Roderick expressed approbation of my views, which were somewhat opposed to the strictly uniformitarian theories then chiefly in vogue. Words of encouragement falling from so great a man could not fail to be valuable to an amateur at his first venture before a learned Society; and that the same Society should after many years endorse in so appropriate a manner the favourable opinion which he expressed of my early effort affords me the greatest satisfaction.

Award of the Murchison Geological Fund.

The President then handed the Balance of the Proceeds of the Murchison Geological Fund to Mr. G. J. Williams, F.G.S., addressing him as follows:—

Mr. Williams,—

The Balance of the Proceeds of the Murchison Geological Fund has been awarded to you by the Council in token of appreciation of your active researches amongst the Cambrian and Ordovician rocks of Ffestiniog and Harlech. You have done good petrological and palæontological work, both in the selection of rocks for thin sections and in amassing a fine series of fossils. The exhibition of a portion of your collection at Chester, on the occasion of the International Congress Excursion in 1888, proved to be of great interest. The Council hope that this Award may be fruitful, in inducing you to persevere on the lines which you have already adopted with so much success.

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Mr. WILLIAMS, in reply, said :—

Mr. PRESIDENT,—

I beg to thank the Council of the Geological Society for the wholly unexpected honour they have conferred on me in awarding me the Balance of the Proceeds of the Murchison Geological Fund. I have been able to do but little work in the past, and I look upon this Award as an aid to further research rather than a recognition of work already accomplished. If anything is needed as an incentive to further work, in addition to the pleasure derived from the work itself, I shall be able to look back on this Award as a "spur to prick the sides of my intent."

AWARD OF THE LYELL MEDAL.

In presenting the Lyell Medal to Mr. E. TULLEY NEWTON, F.G.S., the PRESIDENT addressed him as follows :—

Mr. NEWTON,—

The Council have awarded to you the Lyell Medal, with a sum of Twenty-five Pounds, in recognition of the valuable services you have rendered to British Palæontology. In addition to your well-known memoirs, 'On the Chimæroid Fishes of the Cretaceous Rocks' and 'On the Vertebrata of the Forest-bed Series,' published by the Geological Survey, you continue to contribute important papers to the Royal, Geological, and Zoological Societies, to the 'Geological Magazine,' and to the Geologists' Association. Nor must we forget the very valuable synopsis of the Animal Kingdom brought out by you in 1887.

Your knowledge of the fossil Mollusca has been made available by way of joint contribution to more than one paper, while you have further increased our knowledge of the Vertebrata of the British Isles in almost every class. The Fishes have always constituted one of your favourite subjects, and lately you have brought to notice a new species of *Clupea* from the Oligocene of the Isle of Wight, and a form of *Semionotus* from the Keuper of Warwick, besides contributing to the history of Eocene Siluroids. Your recent papers in the Proceedings of the Royal Society prove that you have not neglected the Reptilia, while your 'Further Contribution to the History of the Norfolk Forest-bed' and your Notice of

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some new Mammals from the Crags show that the Mammalia have not been forgotten. Even in the class Aves you have indicated the presence of the Red-throated Diver in Pleistocene Beds at Mundesley, and more recently you have described *Gastornis Klaasseni* from the Lower Eocene of Croydon.

In presenting you with this token of their appreciation of your work, the Council feel sure that you are by no means likely to relax those efforts in descriptive palæontology which have already borne such excellent fruit.

Mr. Newton, in reply, said:—

Mr. President,—

I am deeply sensible of the honour which the Geological Society has conferred upon me to-day, by the Award of the Lyell Medal, and regret that the work, of which you, Sir, have spoken so kindly, bears so small a proportion to the reward bestowed upon it; for the Medal of Sir Charles Lyell is in my estimation one of the highest honours which a geologist can hope to receive.

It has been my good fortune to be placed in a position which has brought me valuable specimens to work out, and if the results of my labour are in any way of scientific value, it is due to training, in years gone by, under my esteemed master in science, the Rt. Hon. Professor Huxley.

I receive this Award with the greater pleasure, because it is to me a further evidence of the kindly feeling existing between this Society and the members of the Geological Survey, who are to-day rejoicing and participating in the honours conferred upon two of their colleagues.

I desire to express my warmest thanks to the Council for their much valued Award, and to you, Sir, for the kind words with which it has been accompanied.

Award of the Lyell Geological Fund.

The President then handed one moiety of the Balance of the Proceeds of the Lyell Geological Fund, awarded to Miss Catherine A. Raisin, B.Sc., to Prof. T. G. Bonney, D.Sc., LL.D., F.R.S.,

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V.P.G.S., for transmission to the recipient, addressing him as follows :—

Professor Bonney,—

In asking you to forward to Miss Raisin one moiety of the Balance of the Proceeds of the Lyell Geological Fund, I am performing a very pleasing duty. Miss Raisin's excellent work, both in the field and with the microscope, so far commends itself to the Council that they have readily made this Award to a pupil of whom you may be justly proud. The considerable number of papers which that lady has contributed, both to the Quarterly Journal of the Society and also to the 'Geological Magazine'—all within the last six years—is a proof of her industry, while the papers themselves indicate an excellent knowledge of Petrology and a good eye for country. The Council, in making this Award, wish it to be regarded as an acknowledgment of past work, and at the same time as an encouragement for the future.

Professor Bonney, in reply, said :—

Mr. President,—

I have been requested by Miss Raisin to offer her thanks to the Council and Society in the following terms :—

"It is difficult for me to express the gratification which I feel at the honour that has been conferred upon me by the Council of the Geological Society. It gives me also peculiar pleasure to receive an award associated with the name of Sir Charles Lyell, whose 'Principles of Geology' was one of the earliest books to arouse my enthusiasm in that subject, and who by the terms of his Bequest gave evidence of his interest in the intellectual work of women, and even anticipated that they might in the future take part in scientific investigations. In addition to the personal honour, I welcome this recognition as an encouragement, not to myself only, but also to other women who are working at Geology and at different branches of Natural Science. I can assure the Society that their generous appreciation of the little which I have done will not be thrown away, but that I shall use my best endeavours in the future to carry on work worthy of their kind encouragement, worthy also of the instruction and guidance received at University College, the benefit of which I rejoice to have this opportunity of acknowledging."

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Here I might sit down, but I cannot forbear from expressing my personal gratification at being chosen to represent so earnest and conscientious a worker. It brings me a further gratification. As life is in its afternoon we become conscious, often painfully, that we have failed in fulfilling our earlier ideals. My own work has been smaller in quantity and inferior in quality to what I had hoped, but, when one former pupil receives an Award and another a Medal, when the Secretaries designated for the coming year are two other old pupils, one feels that one has not wholly laboured in vain.

The PRESIDENT then presented the other half of the Balance of the Proceeds of the Lyell Geological Fund to Mr. ALFRED N. LEEDS, addressing him as follows:—

Mr. LEEDS,—

The Council have awarded to you the second moiety of the Balance of the Proceeds of the Lyell Geological Fund, in appreciation of your long-continued and successful endeavours to collect and reconstruct the fossil Vertebrata of the Oxford Clay of the neighbourhood of Peterborough. In making this Award the Council bear in mind the readiness which you have at all times shown to place the materials in your possession at the service of palæontologists desirous of availing themselves of your treasures. The Fund now awarded, besides being a recognition of past services, may help to encourage you to work in the same direction.

Mr. LEEDS, in reply, said:—

Mr. PRESIDENT,—

In returning thanks to yourself and the Council for this Award, I must say how astonished and pleased I was at so unexpected a recognition. It is more than twenty years since my brother (who now resides in New Zealand) and I began to collect fossils from the Oxford Clay. The late Prof. Phillips, of Oxford, was the first geologist to describe some of our specimens, which are also figured in his 'Geology of Oxford.' In 1874 Prof. Seeley described the remains of *Muræenosaurus*, and since then he, Mr. J. W. Hulke, Mr. R. Lydekker, and Mr. A. Smith Woodward have written many papers for your Society upon other specimens of Saurians and Fishes which we had collected. From all these friends, and

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especially from Dr. H. Woodward, we have received the very greatest encouragement in our work.

You, Sir, have crowned our labours to-day, by your generous approval and the stamp of the 'Lyell Award.'

Award of the Bigsby Medal.

In handing the Bigsby Medal, awarded to Prof. W. J. Sollas, D.Sc., LL.D., M.A., F.R.S., F.G.S., to Mr. J. J. H. Teall, M.A., F.R.S., F.G.S., for transmission to the recipient, the President addressed him in the following words:—

Mr. Teall,—

The Council have awarded to Prof. Sollas the Bigsby Medal in acknowledgment of his continued researches on the morphology and mineral constitution of the Fossil Sponges. Fifteen years have elapsed since a President of this Society, in presenting him with the balance of the proceeds of the Wollaston Donation Fund, expressed a belief that he would continue to benefit Palæontological Science by his researches on these obscure forms of life. That those anticipations have been fully realized the important character of Prof. Sollas's subsequent work in this direction most clearly proves.

But it is not in Palæontology alone that he has evinced his interest in Geological Science, as his paper on the Silurian district of Rhymney and other contributions to the geology of the neighbourhood of Bristol serve to demonstrate. Nor have his efforts relaxed since he became Professor of Geology and Mineralogy in the University of Dublin, as the Transactions of the Royal Dublin Society and the Royal Irish Academy can testify. We recognize the philosophical biologist in his memoir on the Origin of Freshwater Faunas, and the mineralogist and chemist in his contributions to a knowledge of the Granites of Leinster. It is satisfactory to reflect that one who has done so much and in so many ways for science is still sufficiently young to receive the Bigsby Medal, and, should he happily be spared, it is not unreasonable to suppose that still higher honours may await his efforts.

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Mr. Teall, in reply, said :—

Mr. President,—

I have been requested by my friend Prof. Sollas to express his thanks to the Council of the Geological Society for the honour which they have conferred upon him. Had he been present in person I feel sure that he would also have thanked you, Sir, for the kind words with which you have accompanied the Award. He desires me to read the following communication :—

"If the first impulse in the study of science arise from a longing for deeper insight into Nature, a second, at once powerful and innocent, is a desire for the approbation of elders. Thus I gratefully receive this Bigsby Medal awarded me by the Council, finding in it both reward, too little deserved, and stimulus to fresh endeavour.

"My old friend and whilom fellow-student, Mr. Teall, who, by the indulgence of the Society, represents me to-day, was its recipient in 1889, and he concluded his expression of thanks with an eloquent tribute to our revered teacher, Prof. Bonney. Here I can gladly follow where I fain would lead; for if any success has attended my studies, I owe it to the encouragement of our old Tutor, who has never treated the designation 'in loco parentis' as a harmless College fiction, but has made of it through life a veritable truth."

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THE ANNIVERSARY ADDRESS OF THE PRESIDENT,

W. H. Hudleston, Esq., M.A., F.R.S., F.L.S.

Gentlemen,—

Our losses by death since the last Anniversary Meeting have been considerable, although there were but few of the Fellows deceased who participated to any great extent in the work of the Society. No more than five, so far as I can ascertain, contributed to its publications.

Sir Richard Owen, K.C.B., F.R.S., youngest son of Mr. Richard Owen, of Fulmer Place, near Slough, was born at Lancaster on the 20th July, 1804. He was educated at the grammar school of his native town, where he made the acquaintance, amongst others, of Whewell, afterwards Master of Trinity, a firm friend of his for many years. Having evinced an anxiety for a seafaring life, young Owen is stated to have served for a short time as midshipman. Ultimately he returned home, was articled to a surgeon in Lancaster, and about 1823 matriculated in the University of Edinburgh. Two years afterwards he removed to London, where he joined the medical school of St. Bartholomew's Hospital, and in the following year entered himself as a member of the Royal College of Surgeons. On the completion of his medical studies, Mr. Owen settled down to practise in Serle Street, Lincoln's Inn Fields.

It must often have occurred to those who are fond of tracing the early history of a celebrity that opportunity seems to have been the making of most men. We need not, however, suppose that if Owen had continued to apply himself exclusively to private practice, or had joined the medical department of the Navy, he might not afterwards have become a distinguished anatomist. Indeed, we know of one who did actually, at the outset of life, make choice of the latter profession, and who ultimately rivalled Owen himself in the very branch of science he had chosen to make his own. The year 1828 witnessed the turning-point in Owen's career. There can be no doubt that the rising talent and skill of his pupil had been duly noted by Abernethy, at whose suggestion he was employed by the College of Surgeons to assist in making a catalogue of the Hunterian Collection. From that day onwards his long public life was, with possibly one exception, an uninterrupted success.

It is by no means necessary on the present occasion to enumerate

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all the steps in this remarkable career, which, indeed, has already formed the subject of many a chronicle. With reference to this period of his life it may be sufficient to say that in 1830 an instalment of the Catalogue was published. In the same year Mr. Owen read a paper on the Anatomy of the Orang-utan at the very first meeting of the Zoological Society's Committee of Science. He afterwards made several important contributions to that Society's publications, and was in fact for many years their unpaid prosector. In 1832 he wrote his well-known memoir on the Pearly Nautilus, and in 1834 was appointed to the newly-established Chair of Comparative Anatomy at St. Bartholomew's. In 1835 he married the daughter of Mr. Clift.

It is in this latter year that we find the first allusion to Owen in the publications of the Geological Society. Dr. Mantell, it appears, had read a paper with reference to the discovery of bird-bones in the Tilgate Forest Beds, and, as doubts had been expressed, he placed his specimens in the hands of 'Mr. Owen, of the College of Surgeons,' who pointed out one bone as decidedly belonging to a wader. In April 1837 the first paper of the Hunterian Professor of Anatomy was read before the Geological Society. It contained a description of *Toxodon platensis*, an extinct Mammal of gigantic size, referable by its dentition to the Rodentia, but with affinities towards the Pachydermata and the herbivorous Cetacea. Charles Lyell and Charles Darwin were then Secretaries of the Society. On May 31st in the same year Prof. Owen was elected a Fellow of the Society (F.R.S. in 1836) in company with Mr. James Heywood, of Manchester, whose name still remains upon our books. Owen's certificate on that occasion was signed, amongst others, by R. Hutton, R. I. Murchison, C. Darwin, L. Horner, and J. Phillips.

As an instance of the way in which honours came thick upon him, Prof. Owen, when only 34 years of age (in 1838), received the Wollaston Medal, awarded, as his friend Dr. Whewell remarked, for his services to 'Fossil Zoology' in general, and in particular for the description of the Fossil Mammalia collected by Mr. Darwin. The President further expressed a hope that this early recognition of the Medallist's services might be regarded as a token of interest in future investigations. Owen, in reply, confessed that since he had pursued anatomical investigations in connexion with fossil remains he had been rewarded by new and extrinsic pleasures. To this source he traced his connexion with the Geological Society and the

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possession of some most valued friendships. He received this testimony as a strong stimulus to future endeavours, and pledged himself to lose no available time in furthering that branch of Geological Science which deals with extinct animals. Thus it was that the comparative anatomist of the College of Surgeons was induced to become a palæontologist. That the Wollaston Medallist of 1838 amply redeemed his promises the publications of our own Society and of the Palæontographical Society, to mention no others, bear most convincing testimony.

As regards Prof. Owen's further connexion with this Society, other than as a contributor to its publications, he appears to have been on the Council at different times between the years 1838 and 1857 inclusive, acting as Vice-President in 1845, 1847, and 1853. It is said that the Presidency of the Society was offered to him and that he declined it, but no authority can be given for the statement, neither is anything known as to the period when this supposed offer was made. The only thing we can say for certain is that since 1857, being the year he was elected President of the British Association, he took no active part in the administration of the affairs of this Society.

It would be no easy task to enumerate all the honours and appointments which fell to the lot of Prof. Owen during a career which we may regard as having been fully established in the pre-Victorian era, though attaining its zenith during the present reign. Six years after the award of the Wollaston Medal he received the Royal Medal from the Royal Society for his descriptive memoir on the Belemnites of the Oxford Clay, and he was further awarded the Copley Medal from the same Society in 1851. Rarely has a *savant* met with such an amount of recognition from nearly all quarters. He received (1858) the appointment of Fullerian Professor of Physiology in the Royal Institution, was made LL.D. of Cambridge and D.C.L. of Oxford. About the same time, in accordance with the wish of the late Prince Consort, Prof. Owen was requested by Her Majesty to deliver at Buckingham Palace a course of lectures on the elements of natural history, including zoology and geology. From the late Emperor of the French he received the insignia of the Legion of Honour, from the King of Italy the order of St. Maurice and St. Lazarus, and from the King of Prussia the Star of the Order of Merit; whilst in the 'Prix Cuvier,' awarded by the Institute of France, he obtained a recognition from that body which was peculiarly appropriate.

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Prof. Owen's connexion with the College of Surgeons terminated in 1856, when he was appointed Superintendent of the Natural History Department in the British Museum, a post which he was the first to occupy and which he filled with so much ability for twenty-eight years. The great event of his reign was the transfer of the collections from Bloomsbury to South Kensington. His efforts to obtain more accommodation for the accumulating material, and how he was thwarted by one set of politicians and encouraged by another, are matters of history. Suffice it to say that the money was ultimately voted and the plans drawn out, though his biographer will probably repudiate responsibility on Owen's part for the peculiarities of that remarkable building. On Easter Monday, 1881, the new Museum of Natural History was opened for the first time to the public.

Prof. Owen received the Knight-Commandership of the Bath on resigning the post of Director in 1884, and thereafter he lived more or less in retirement at his prettily situated residence in Richmond Park, which had been assigned to him by Her Majesty in 1852. There, we are told, it was his pleasure to receive his numerous friends and such foreign visitors as were desirous of enjoying the society and reminiscences of the clever and entertaining old *savant*. And thus was spent the evening of his long and useful life, in fairly robust health and in the full possession of his faculties. When the last days came, his strong constitution delayed for long the inevitable hour, and he finally passed away on December 18th, 1892, in the 89th year of his age.

The Council at the ensuing meeting deputed Prof. Judd and Dr. Hicks to represent the Society at the funeral, and a resolution of condolence was likewise passed and communicated to the late Professor's grandson. Sir Richard Owen having expressed a desire to be buried in Ham churchyard, the funeral took place there on the 23rd December. Amongst those present was the Duke of Teck, who placed on the coffin a wreath in token of sincere admiration and affection on his own part and that of the Duchess. The scientific societies and many other public institutions were represented by officers specially deputed to attend. A few days afterwards a preliminary meeting was held at the house of Sir James Paget to consider what steps should be taken with regard to a suitable memorial, when it was decided that a committee should be formed to make the necessary preparations. Subsequently the Prince of Wales consented to become Chairman of the Committee, and a

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meeting was held at the rooms of the Royal Society on the 21st January, 1893, when it was decided that the memorial should consist primarily of a marble statue to be placed in the hall of the Natural History Museum. It was also determined that a Memorial Catalogue of Owen's works should be issued.

Whatever memorial may ultimately be raised in his honour, it must be confessed that Sir Richard Owen's publications are of themselves a monument of his talent and industry. On looking over the Royal Society's Catalogue one is tempted to exclaim 'Prodigious!' No less than 368 memoirs and papers of his are enumerated down to the end of 1872, and he has been credited with some 60 after that date; of these 28 were printed in the Quarterly Journal of this Society. We ourselves are chiefly concerned with his palæontological work, and especially with those portions of it which appeared in our own publications and in those of the Palæontographical Society.

With the latter Society Owen may be said to have established the most intimate relations. It was in 1848 that he first offered a Monograph on the British Fossil Reptiles, and in the following year he became a member of their Council, being re-elected on many occasions in succeeding years. In 1867 he was elected a Vice-President, and he retained that office until 1877, when he was elected the fourth President of the Society on the death of Dr. Bowerbank. It is almost needless to remind you that he continued to be President until the day of his death, although the last time he occupied the Chair was at a Council meeting in June 1887. Meanwhile his promised Monograph had expanded into a series of monographs, on which he continued to work for a period of over thirty years. The 'Reptilia of the London Clay,' commenced in 1848, was completed in 1880: this includes the Bracklesham and other Tertiary beds. The 'Reptilia of the Cretaceous Formations,' commenced in 1851, was completed in 1862. The 'Reptilia of the Wealden and Purbeck Formations,' commenced in 1853, was completed in 1879. This is an immense work, running into thirteen separate numbers. The 'Reptilia of the Kimeridge Clay Formation' was commenced in 1859 and concluded in 1868. The 'Reptilia of the Liassic Formations,' begun in 1859, was concluded in 1869. The 'Reptilia of the Mesozoic Formations,' the 'Red Crag Cetacea,' and the 'Mammalia of the Mesozoic Formations' must also be added to this list. A 'History of British Fossil Reptiles,' in three volumes, was published in 1884, with abundant illustrations, in which the memoirs already mentioned, with some others, were collected.

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Other societies and institutions were also favoured by Prof. Owen; as examples I may mention 'Researches on Fossil Remains of the Extinct Mammals of Australia, with a notice of the Extinct Marsupials of England,' published by the Zoological Society, and 'Fossil Reptilia of South Africa in the Collection of the British Museum,' published by order of the Trustees. Besides these, we must not forget to enumerate his 'Classification and Distribution of Mammals' (1859), his 'Manual of Palæontology' (1861), and, to go very far back indeed, his 'Odontography,' published between 1840–45.

His communications to the Geological Society vary much in length; but, taking great and small together, 85 papers are set down to his name. Vols. vi. and vii. of the second series of the Transactions are especially rich in communications from this author, the quarto plates offering advantages for illustration. He clears up doubts as to the marsupial character of *Thylacotherium* and *Phascolotherium* from the Stonesfield Slate, and combats the notion that the so-called *Basilosaurus* was a reptile possessing teeth with double fangs. Five quarto plates are devoted to the illustration of a species of *Glyptodon* from South America, whilst three classes of Vertebrates are noticed from the London Clay, and descriptions given of five species of *Labyrinthodon* from Warwickshire. Of course, all this is ancient history, but it may serve to direct attention for a moment to what was going on at the Geological Society fifty years ago. Several years later he writes largely on *Dicynodon*. His description of *Hyopotamus* from the Isle of Wight is also of this period. In our Quarterly Journal his papers have been numerous, but many of them are rather short. The Vertebrates of South Africa have always held an important place in these communications.

Referring to Owen's work generally, none but an expert must presume to venture an opinion. Criticisms on his numerous speculative treatises would nowadays be somewhat out of date. His opposition to what was once called Darwinism is a curious episode in his career. At the celebrated meeting of the British Association at Oxford in 1860 his assistance was of use in enabling the anti-Darwinians to maintain a good defensive position; but two years later, at Cambridge, even Owen's powers of persuasion could not avert defeat. His attitude has been attributed to various causes, such as a predilection for bishops, or to jealousy that others should have forestalled him in interpreting the great riddle of the succession of life. Whatever may have been the cause, it is admitted that the researches of Owen himself paved the way for the reception of

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the doctrine of Evolution, nor was his attitude in later years one of active hostility.

When all is summed up, we recognize in Owen a man highly gifted by Nature, and who knew how to make use of his talents—a rare faculty in a genius, as Owen most undoubtedly was. His very presence had in it something remarkable, and that he possessed the power of fascinating his hearers is amply testified by what fell from the Prince of Wales on a recent occasion. Some people may fancy that cataloguing museum specimens and describing the remains of extinct animals is necessarily associated with a peculiarity of character in unison with the subject. But the whole history of Owen contradicts such a supposition. Skilled beyond others in the science of comparative anatomy, an eloquent lecturer, a courteous and sympathetic official, an indefatigable writer, Owen also presented a bright social side, as those who had the pleasure of knowing him have ever testified. Surely we cannot be far wrong in ranking him among the Great Men of the Nineteenth Century.

Henry Francis Blanford, F.R.S., was born in 1834 in Bouverie Street, Whitefriars, where his father had a manufactory, on the site of the 'Daily News' printing-office. His early education was obtained at private schools in Brighton and Brussels, and after studying for some time at the old School of Design in Somerset House, he joined the Royal School of Mines at its commencement in 1851, and a life that might otherwise very possibly have been devoted to art, for he was an admirable draughtsman, was thenceforward gained to science. At the Royal School of Mines he took the first place in his year, and received the Duke of Cornwall's Scholarship, then the only prize. After a year's study in Freiberg and another year in London, which he employed in preparing a translation of v. Kobell's work on the Blowpipe, his first publication, he was appointed to the staff of the Geological Survey of India, together with his brother, Mr. W. T. Blanford, and landed in Calcutta at the end of September, 1855.

Almost immediately after their arrival in India, the two brothers and Mr. W. Theobald were despatched to examine and report upon an almost unknown coal-field around Talchir in Orissa. The work done was chiefly memorable geologically for one discovery, that of the Talchir boulder-bed, and for the circumstance that, chiefly through Mr. H. F. Blanford's observations, the first step was taken towards the classification of the remarkable series of beds associated

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with the Indian coal-bearing rocks, for both the underlying Talchir division and an overlying mass were separated from the Damuda or true coal-bearing beds. For some time after this Mr. H. F. Blanford was engaged in Calcutta in charge of the Survey Office, and was occupied with palæontological work in the Museum, but in 1857 he was placed at the head of a strong Survey party that was despatched to Madras, and he was chiefly engaged for the next three or four years in examining the Cretaceous beds near Trichinopoly and Pondicherry, some fossils from which, described by Prof. E. Forbes and Sir P. Egerton, had attracted much attention in Europe. The stratigraphical work on the Indian Cretaceous beds was mainly palæontological, but the classification established by Mr. Blanford was fully confirmed by Dr. F. Stoliczka's well-known description of the fauna. A commencement of this description was made by Mr. Blanford himself, who published an account of the Nautilidæ and Belemnitidæ in the 'Palæontologia Indica' before he left the Survey in 1862. The geology of the area was described in a report published in the fourth volume of the Memoirs of the Geological Survey of India. An account of the geology of the Nilghiri Hills in the first volume of the same Memoirs was the only other report on the Madras Presidency by Mr. Blanford that was published by the Survey.

The causes of Mr. Blanford's retirement from the Survey were partly injury to his health produced by exposure to the climate, partly strained personal relations with the Superintendent of the Survey, the late Dr. T. Oldham. After staying for a short time in Europe and recovering his health, Mr. Blanford was appointed to the Science Professorship at the Presidency College, Calcutta, and was from 1864 to 1872 on the staff of the Bengal Educational Department. He became in 1864 one of the Hon. Secretaries of the Asiatic Society of Bengal, and about this time took up the subject of Indian meteorology, at first in connexion with cyclonic storms, of which a very severe one visited Calcutta in 1864. He was for some years a member of a Meteorological Committee appointed by the Government; in 1867 he became Meteorological Reporter to the Government of Bengal; and finally, in 1874, a new department having been formed by the Government of India, he was placed at its head. This post of Meteorological Reporter to the Government of India he held until his retirement from the Indian Service in 1888. After his retirement he resided at Folkestone until his death on January 23rd, 1893.

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Besides a number of important reports and works on meteorology, Mr. Blanford was author of several papers on fossil and recent mollusca and of two treatises on the geography of India. One of these has been used for many years as a text-book by schools and colleges in India; the other is a recent publication, and forms one of Macmillan's Geographical Series, published under the editorship of Sir Archibald Geikie. Another recent publication of Mr. Blanford's is 'A Practical Guide to the Climates and Weather of India, Ceylon, and Burma, and the Storms of Indian Seas.' He also wrote, in conjunction with the late Mr. J. W. Salter, the Palæontology of Niti. His only contribution to the Quarterly Journal of this Society was an important paper published in 1875 on 'The Age and Correlation of the Plant-bearing Series of India, and the former existence of an Indo-Oceanic Continent.'

Mr. H. F. Blanford became a Fellow of the Geological Society in 1862 and of the Royal Society in 1880. He was President of the Asiatic Society of Bengal in 1884–85.

Thomas William Fletcher, M.A., F.R.S., F.S.A., late Colonel in the Staffordshire Militia, was born at Darlaston, Staffordshire, on the 25th May, 1808. He was educated at Dublin, and took his M.A. at that University, being also an M.A. of Oxford. For some years he practised as a solicitor at Dudley, and in 1860 became a barrister of the Inner Temple. At one time he was much interested in the fossils of his native county, and in 1850 contributed two short papers on Dudley Trilobites to our Quarterly Journal. When the meeting of the British Association took place at Dudley in 1849 his collection attracted the attention of several notabilities, among whom were Prince Charles Lucien Bonaparte, Sir R. Murchison, Drouyn de Lhuys, Joachim Barrande, Edward Forbes, etc. Subsequently Colonel Fletcher parted with his collection to the Woodwardian Museum, and apparently ceased to collect fossils. Nevertheless, he is said to have taken an interest in geology to the last, and often attended the field meetings of the Dudley Geological Society. He died at Launeswood House, near Stourbridge, on the 1st February, 1893, within a few months of completing his 85th year.

Thomas Davies was born on the 29th December, 1837, in the neighbourhood of London. He was the son of Mr. William Davies, F.G.S., of the Geological Department of the British Museum. Having somewhat of a roving disposition, he went to sea at the age

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of 14, and during the four years that he was afloat visited India, Singapore, China, South America, and other countries. In 1858 he was appointed a third-class assistant in the Mineral Department of the British Museum under Prof. Maskelyne, and became a junior assistant in 1863. For nine years he was Prof. Maskelyne's only assistant, and it was in the arrangement and labelling of the immense mass of specimens under that gentleman's supervision that he acquired an eye-knowledge of minerals which has rarely been surpassed. Subsequently, under the same tuition, he obtained a knowledge of the microscopic characters of rock-forming minerals, which rendered him a very practical petrologist.

In 1880 Mr. Davies was promoted to the grade of first-class assistant, and by a singular coincidence his father, Mr. William Davies, obtained similar promotion in another department of the British Museum on the very same day. In that year also Mr. T. Davies was awarded the Balance of the Proceeds of the Wollaston Fund, the then President specially commenting upon the generous assistance he was so ready to afford to others. He became a Fellow of this Society in 1870, served on the Council during 1886–87, and contributed appendices on the microscopical structure of rocks to papers written by Dr. Hicks.

His publications were not numerous, although he contributed articles on mineralogy and petrology to more than one Magazine. Of late years, however, he took a deep interest in the Mineralogical Society, of which he was one of the original members, and for a long time was Foreign Secretary and practically Editor of their Journal, his very considerable knowledge of French and German being of material service to him in this connexion. One feature was particularly conspicuous in Mr. Davies, viz. his readiness to oblige. Thus he earned the goodwill of his colleagues, and of those numerous friends and acquaintances who were so ready to avail themselves of his practical knowledge in the judging of minerals. About two and a half years ago he was attacked by serious illness, and though he recovered for a time, his constitution was too severely shaken, and he died at East Acton on December 21st, 1892, within a few days of completing his 55th year.

Henry John Marten, M.Inst.C.E., was born in 1827. He was a well-known hydraulic engineer, and had been adviser to the Board of Agriculture, the Severn Commissioners, and the Staffordshire and Worcestershire Canal Company. He became a Fellow of this

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Society in 1888, and two years afterwards read a paper 'On some Water-worn and Pebble-worn Stones taken from the Apron of the Holt-Fleet Weir on the River Severn.' Quite recently, Mr. Marten gave evidence before the Royal Commissioners on Water Supply as to the practicability of constructing storage-reservoirs in the Upper Thames Valley. He died on November 3rd, 1892, in his 66th year.

Edward Hammond Hargraves, late of Sydney, New South Wales, was born at Gosport on October 7th, 1816, being the third son of John Edwards Hargraves, then a Lieutenant in the Sussex Militia. E. H. Hargraves was educated at Brighton Grammar School, and afterwards at Lewes. When 14 years of age he went to sea and had to 'rough it' on board a merchant-vessel for nearly three years, ultimately landing in Australia in 1832. After a few more years devoted to a roving life, we find him engaged as a rearer of stock in Eastern Australia, where he appears to have been not unmindful of the geological features of that district, which was afterwards to become the scene of his celebrated discovery of gold.

Not being very successful in business, he sailed for California in 1849, in the hope of making a fortune by gold-mining. His experiences in that region quickly convinced him of the similarity in structure that existed between the auriferous rocks of California and certain districts in New South Wales with which he was well acquainted. Mr. Hargraves accordingly returned to the country of his adoption, and on the 4th February, 1851, set out from Sydney for the region where he expected to find gold. On the 12th of that month, having arrived at Lewis Ponds Creek, he succeeded in proving to his companion that they had been walking on gold, since, after a few washings on a small scale, it was clearly demonstrated that the alluvium was auriferous, and subsequently a considerable quantity of gold was obtained by the party. Ultimately, Mr. Hargraves was instructed to point out the gold-field to the Government Geologist, whom he accompanied to Ophir, a place since then well-known in the annals of Australian gold-mining. Not many weeks elapsed before the usual rush of prospectors ensued, and the once lonely spot suddenly became populous.

Some of us, perhaps, are old enough to remember the controversies which took place forty years ago with reference to the first discovery of gold in Australia. The disputed claims of Sir Roderick Murchison and the Rev. W. B. Clarke to the honour of the *scientific* discovery are matters of history. Although there had been accidental

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discoveries of small samples of gold at various times, it is a singular circumstance that Count Strzelecki's work on New South Wales, published in 1845, contains no allusion to the presence of gold in the rocks of that country. However, it cannot be doubted that the subject of the present notice was the first practical discoverer of gold in Australia, and as such received many valuable gifts and testimonials. He was made Commissioner of Crown Lands in New South Wales, and on his vacating that office the Legislative Council awarded him £10,000, a sum which he considered scarcely adequate, bearing in mind the enormous amount of wealth that his discovery had brought to that colony.

In 1854 we find Mr. Hargraves in England, and in the following year he brought out his work on Australia and its Gold Fields, which was published in London. In that year also he became a Fellow of the Geological Society, though we do not appear to have received any papers at his hands. Nevertheless, he was evidently a man with considerable powers of observation, a geologist by instinct, as it were, and the chapter which treats of the scientific and practical discoveries of gold in Australia is an interesting geological disquisition.

We do not know much of his later life, though it is said that throughout his career he was more remarkable for generosity than prudence. The 25th anniversary of the great gold discovery was duly kept at Sydney in 1876, shortly before which event the Parliament of New South Wales granted him a pension for his services. In the Queen's Jubilee year, being the 36th since the discovery of gold in New South Wales, then comprising the Colony of Victoria, he made a last appeal to the Legislature of the latter colony to fulfil their obligations towards him, obligations which they had admitted but never discharged. Whether or no he was successful in this application is unknown to me.

He died, presumably at Sydney, on October 30th, 1891, at the age of 75. The announcement of his death did not reach this Society until the autumn of the following year.

John Murray, the third of that name, was born in London on the 16th April, 1808. He received his early education at Charterhouse, and proceeded thence to the University of Edinburgh, where his attention was much drawn to Natural Science. In 1828, at the early age of 20, he joined his father's business, as one of the firm of well-known publishers in Albemarle Street, and in the same year he

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appears to have become a Fellow of this Society, before he was 21 years of age. Consequently, although not the oldest Fellow at the time of his death, he was the Father of the Society when that event occurred, having been a contributing Fellow for 64 years.

In early life John Murray developed a taste for travelling, and when 21 years of age visited Belgium, and in the following year France and Italy. We are told that he travelled, note-book in hand, preserving an ample record of places and events; so that, in this way, at a comparatively early stage of his career, he originated the famous series of handbooks, which for many years enjoyed almost a monopoly amongst the travelling public—before, in fact, he succeeded to his father's business in 1843.

John Murray was one of the original Fellows of the Royal Geographical Society; he sat on the Council of that Society as long ago as 1850 and subsequently. He was of frequent assistance to Murchison, who in his later years almost made that Society his home. Murray had also been associated with the Royal Agricultural Society from its commencement, and had arranged with Mr. Philip Pusey, fifty-four years ago, the terms on which their Journal was originally published.

He does not appear ever to have taken an active part in the affairs of this Society, and from the fact that no cross is attached to his name in our List I conclude that he never contributed to its publications. Nevertheless he was a man of letters, a scholar as well as a publisher, and was especially interested in physiographical problems. An anonymous brochure entitled 'Scepticism in Geology,' published in 1877, is attributed to his pen. This work to a certain extent seems to have reflected the views of Murchison, since it was a kind of protest against the ultra-uniformitarianism which then prevailed. The Author more especially opposed the fashion of attributing all the features of the earth's surface to denudation, and protested strongly against Ramsay's theory of lake-basins.

Mr. Murray died in London on the 2nd April, 1892, aged 84 years. At his funeral, to meet the convenience of personal friends, among whom was Mr. Gladstone, the first part of the burial service was read at St. James's Church, Piccadilly, whence his remains were finally transferred to Wimbledon.

William Reed was born at Malton, in Yorkshire, on the 21st December, 1810. He was educated at Monkman's School in York, and afterwards at Thornton, near Pickering. After having been

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duly articled to a local surgeon, he studied Medicine and Surgery both in Leeds and in London, and in 1838 became a Member of the Royal College of Surgeons. From 1839 to 1842 he was House-Surgeon of the York County Hospital, and towards the close of the latter year he proceeded to Paris and attended lectures in the Faculté de Médecine. Returning to England in 1843 he commenced a country practice at Whitwell, a village on the Oolites a few miles west of his native Malton. Thence he ultimately removed to York, where for upwards of 30 years he applied himself with much success to the work of a general practitioner. In his later years he relinquished practice, and continued to devote a great part of his time to the increase of his already large collection of fossils.

There can be very little doubt that Mr. Reed strengthened, if he did not imbibe, his taste for fossils in the pleasant valley of Derwent, where he first settled down to practise after his return from France. His collection of the Inferior Oolite fossils of that district, carefully separated from those of the Coralline Oolite of Malton itself, is a fairly good one and was of much use in assisting geologists to discriminate between the two formations. It gives me great pleasure to record the assistance that I have myself received from him in that respect. In early days, Mr. Reed's specimens were mainly the spoils of his own hammer, but as time went on his attention was largely devoted to the purchase of collections, and year after year he kept adding to the stock until the house in Blake Street was full to overflowing. Indeed his work in Geology seems to have been chiefly in this direction, for there is no record of his having written anything except a short note on a boring at Masham. Fortunately, as Honorary Curator in Geology to the Yorkshire Philosophical Society, this king of collectors found a legitimate outlet for his accumulating treasures. In their excellent Museum at York, Mr. Reed had the pleasure of arranging the different collections which from time to time he had presented to them, and almost to the day of his death found a congenial occupation in making good any deficiencies which might happen to be noticed.

He died at York on May 9th, 1892, after a short illness, in his 82nd year.

Sir James Brunlees, M.Inst.C.E., F.R.S.E., was born at Kelso on the 5th January, 1816. After leaving school he was put by his father to gardening and farm work, with the intention of his being trained as a landscape gardener. Having a desire for a higher

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education he went to the University of Edinburgh for two sessions, and there made the acquaintance of Mr. Alexander Adie, by whom he was engaged in 1838 as his assistant on the Bolton and Preston Railway. This engagement seems to have fixed his career in life, and subsequently he had an important share in the construction of many railways both in this country and abroad. He became a Fellow of this Society in 1862. In May 1886 he received the honour of Knighthood in connexion with the Mersey Tunnel Railway. He was a Past-President of the Institution of Civil Engineers and a Fellow of the Royal Society of Edinburgh.

He died at Wimbledon on the 2nd June, 1892, at the age of 76.

Lewis Llewellyn Dillwyn was born at Swansea in 1814, being the second son of Mr. Lewis Weston Dillwyn, of Sketty Hall, a well-known botanist and student of Natural History. The Dillwyn family originated in the county of Hereford, but migrated with William Penn in 1699; and thus it happened that the grandfather of our deceased Fellow was born in Pennsylvania. The Dillwyns were first associated with Swansea in connexion with the Cambrian Pottery Works. Mr. L. L. Dillwyn married in 1838 the daughter and heiress of Sir Henry de la Beche. He was a magistrate and deputy-lieutenant of the county of Glamorgan, and Lieutenant-Colonel Commandant of the Glamorganshire Rifle Volunteers. Although a Fellow of this Society and also of the Linnean, his energies seem to have been mainly directed to politics. He was elected member for Swansea in 1855 and continued to represent that borough in each successive Parliament until his death, which occurred very suddenly on June 19th, 1892, during the excitement of the last general election, when he was in the 79th year of his age.

Alexander Norman Tate was born in 1837, at Wells in Somerset, and educated at the Chapter Grammar School of that city. He early evinced a taste for chemistry, and having entered the laboratory of the late Dr. Muspratt at Liverpool, he ultimately became one of the principal consulting chemists in that neighbourhood, being especially recognized as a leading authority on petroleum.

His public educational work commenced soon after he settled in Liverpool, and both by teaching and lecturing he did much to popularize science. Besides having initiated, in conjunction with Mr. James Samuelson, the Liverpool Science and Art Classes, he established the Liverpool Science and Art Teachers' Association and

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took a strong interest also in the geological work of that city and neighbourhood. Although his special subjects were chemistry, physiology, botany, and general biology, he did good service to Geology by analysing many of the rocks in the neighbourhood of Liverpool. Thus he discovered the presence of *iserine* in the decomposed greenstones of the Boulder-clay in the valley of the Mersey, and showed that the colour of certain black bands in the local Triassic sandstones was due to the presence of manganese. The Proceedings of the Liverpool Geological Society contain many of his memoirs. About five years ago Mr. Tate became a Fellow of this Society, and although he never contributed anything to our Proceedings, we may well believe that, had he been spared, so promising a recruit would have enriched the Quarterly Journal with more than one valuable paper.

He died, after a long illness, on July 22nd, 1892, at the comparatively early age of 55, leaving a distinct void, we are told, in the intellectual life of Liverpool.

David Corse Glen was born at Hawkhead, near Glasgow, in 1823. He received his early education in Paisley and at Glasgow Grammar School, and having turned his attention to engineering, ultimately became partner in the firm of Glen and Ross. Prospering in business, he had the opportunity of indulging his scientific tastes, which were in the direction of Geology and especially of Mineralogy. From the year 1860, Mr. Glen was an active member of the Glasgow Geological Society, frequently representing that Society at the meetings of the British Association. He became a Fellow of this Society in 1876 and occasionally attended the meetings till within two or three years ago. He is said to have possessed one of the finest private collections of minerals in Scotland, which he was always glad to show to strangers interested in the subject; indeed, for many years, his scientific friends were entertained annually at his own house, where his collections were exhibited and explained.

Mr. Glen, who, in addition to his scientific qualifications, was a public-spirited citizen of Glasgow, died in November, 1892, at the age of 68.

John Hooke Taunton, M.Inst.C.E., was born in April, 1820, at Totnes, in Devonshire. For many years he was engineer to the Thames and Severn Canal. Having always paid great attention to the Springs and Water Supply of the Cotteswold area, he was

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regarded as an authority on the water question, and contributed valuable information to the Report of the Royal Commission on Water Supply in 1869.

As an old Member of the Cotteswold Naturalists' Field Club, he contributed papers on the Hydrology of the Cotteswolds, on the Geology of the Sapperton Tunnel, and other subjects. Less than a twelvemonth has elapsed since he made an interesting communication to that Club on the Dynamic Geology of Palestine, in which the salient features of that remarkable region were well described.

Mr. Taunton resided latterly at Stuart House, near Stroud, where he died on the 31st January, 1893, aged 73.

Thomas Wynne, M.Inst.C.E., was born at Tenbury on the 7th February, 1807, and was educated at Ledbury. About the year 1830 he removed into Staffordshire, where he turned his attention to the study of mine-engineering, became managing partner in a Colliery Company, and practised as a consulting engineer. Mr. Wynne was appointed one of H.M. Inspectors of Mines in 1852, and two years afterwards became a Fellow of this Society. Throughout life he took an active and intelligent interest in all engineering and mining discoveries, and there were few subjects of this nature with which he was not practically conversant. He resided at the Manor House, near Gnosall in Staffordshire, where he died on June 4th, 1891, in the 85th year of his age. The announcement of his death did not reach this Society until the autumn of the following year.

John Strong Newberry, Professor of Geology in Columbia University, New York City, was born on the 22nd of December, 1822, at Windsor, Connecticut. He graduated at Western Reserve College in 1846, and at the Cleveland Medical School in 1848, and began the practice of medicine at Cleveland, Ohio, in 1851. In 1855 he commenced his labours in Geology, the science to which, in connexion with its fellow-science, Palæontology, he devoted the chief part of his remaining years. He received in that year an appointment as geologist and botanist of the expedition sent out by the U.S. Government under Lieutenant Williamson to explore the region on the Pacific between San Francisco and the Columbia River; and the 6th volume of the Government Reports on a 'Practical Route for a Railroad to the Pacific,' published in 1857, contains the results of his work.

In 1857 and 1858 he was engaged in exploring the Colorado

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River on the expedition under Lieutenant Ives. The party ascended the river in a steamer for 500 miles from its mouth, and brought back grand views of the wonderful scenery of the cañon, then for the first time explored, for the illustration of his excellent Geological Report, as well as for that of the Commander of the Expedition. Again in 1859 he was geologist of the Government expedition under Captain Macomb, which explored the country of the San Juan and Upper Colorado, and thus had an opportunity for the geological study of part of Utah, Northern Arizona, and New Mexico. His report appeared, after much delay, in 1876, in connexion with the Report of an Expedition from Santa Fé to the junction of the Grand and Green Rivers. The volume contains, besides a general report on the geology of the regions visited, descriptions by F. B. Meek of his Cretaceous fossils, and by himself of the other fossils, including Carboniferous Brachiopods and Fishes, and Triassic plants from Abiquiu, New Mexico, and Sonora, Mexico, the figures of the plants occupying five of the eight plates.

During the Civil War, Dr. Newberry was a member of the Sanitary Commission for the five years following September 1861, and had charge of the work of the Commission in the valley of the Mississippi.

In 1866 Dr. Newberry received the appointment of Professor of Geology at the Columbia College School of Mines. In 1869 he was made State Geologist of Ohio; and the volumes published on Geology and Palæontology contain much written by him on the stratigraphy of the various parts of the State, but still more on the wonderful collections of Devonian and Carboniferous Fishes which the rocks afforded him, and on numerous fossil plants.

In 1888 Dr. Newberry published, in connexion with the United States Geological Survey, a quarto volume of 95 pages and 26 plates on the Fossil Fishes and Fossil Plants of the Triassic rocks of New Jersey and the Connecticut Valley; and in 1889 a similar volume of 228 pages and 53 plates on the Palæozoic Fishes of North America. A report of like completeness on the Amboy Clays (Cretaceous) of New Jersey was nearly ready for publication two years ago, when a stroke of paralysis put an end to his long and most fruitful scientific labours. Besides his larger reports above mentioned, he published many shorter papers connected with all departments of Geology.

Dr. Newberry was one of the corporate members of the U.S. National Academy of Sciences. He was elected a Foreign Member

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of our Society in 1883, and received the Murchison Medal in 1888. From 1867 until recently he was President of the New York Academy of Sciences. He was a man of great excellence of character. While deeply devoted to science and an earnest worker, he was yet willing to give up several years to the superintendence of soldiers' hospitals at the time of his country's need.

Dr. Newberry died on the 7th December, 1892, within a few days of completing his 70th year.

Nicolai J. von Kokscharow, Major-General in the Russian Army, was born in Siberia on the 5th December, 1818, and at the age of 12 was sent to St. Petersburg to be educated at the Military School of Mines. When only 22 years of age he had the good fortune to be selected to accompany Murchison and De Verneuil during three successive summers, and afterwards De Keyserling, in their extensive journeys through different parts of Russia. Subsequently Kokscharow spent some years in foreign countries, where he had good opportunities for making the acquaintance of distinguished men of science, but always with a leaning towards the mineralogists, of whom, in England, Miller was his chief correspondent.

On his return to Russia he received important appointments in connexion with scientific institutions, all more or less under the government of that country, and ultimately he was appointed to the Directorship of the Institute of Mines, a post which he occupied for 13 years. In 1865 he was made an Honorary Member and Director of the Imperial St. Petersburg Mineralogical Society, afterwards becoming Honorary Director in 1891. Such was the esteem in which he was held by men of science that, when his jubilee was celebrated in 1887, addresses of congratulation from all parts of the world poured in upon the Russian *savant*.

Of his works, which were numerous, the most important is the 'Materialen zur Mineralogie Russlands,' the publication of which, in ten volumes, ranged from 1853 to 1891. We can well believe that a country so rich in minerals as Russia, both European and Asiatic, must have afforded a congenial field for the exercise of Kokscharow's talents, but the Author ultimately included the minerals of other countries in his *magnum opus*. The publications of the Imperial St. Petersburg Mineralogical Society are full of papers by him. A collection of topaz, on which he worked, is now in the British Museum; whilst our own Quarterly Journal contains abstracts of two of his papers furnished by Count Marschall,

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'On Clinochlore and Mica' and 'On Crystallized Euclase in the Ural.' He contributed papers largely to Poggendorf's Annalen, to Silliman's Journal, to Leonhard and Bronn's Jahrbuch, and to the St. Petersburg and Vienna Academies of Science.

He continued to work to the very last, dying at St. Petersburg on the 2nd January, 1893, at the age of 75, and the esteem in which he was held by all classes was amply shown at his funeral in the environs of that city.

ON SOME RECENT WORK OF THE GEOLOGICAL SOCIETY.

Bearing in mind that several of the later occupants of this Chair have selected special subjects for the Anniversary Address, it has occurred to me that some notice of a portion of the work brought before the Society during a limited period might not be without interest to the Fellows. The Quarterly Journal is a rich mine to exploit, and although some portions of it may be rather stiff reading, yet there is a large amount of material which will repay close attention. The limitation which I propose in this case covers a period of about seven years, during which time I have had the honour of serving the Society in one official capacity or another, and consequently have had my attention specially drawn to many of the papers which have been read.

It would of course be out of the question to attempt to deal comprehensively with all the subjects which have been brought before the Society; but as the Fellows might like to be reminded of what we have been doing during this septennial period, it will be convenient to offer a rough classification and enumeration of the communications which have been made. Strict numerical accuracy is not attempted, nor is it claimed that the classification is the best that could be devised. My object is simply to draw your attention to what has been going on, and afterwards to select some one or more subjects for further consideration. In so doing it may be necessary briefly to allude to works outside the publications of the Society.

Certainly one of the most popular subjects has been *Pleistocene Geology*. Many of these papers, as possibly some of you may remember, attracted considerable audiences and were provocative of interesting and prolonged discussions. Upwards of thirty papers have been read dealing with the Pleistocene Geology of the British

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Isles, besides one or two referring to foreign localities. With these may be grouped about half a dozen papers which deal with theoretical questions in connexion with glaciation. It is scarcely necessary to remind you that the Nestor of British Geology, Prof. Prestwich, has been one of the chief contributors to this branch of our science. As the subject is a popular one, I have dwelt upon it at some length, always with the express reservation that I have no special qualifications for the task.

In *Tertiary Geology* there was an important paper by Messrs. P. F. Kendall and R. G. Bell on the Pliocene Beds of St. Erth, and about a dozen papers on various members of the Eocene, especially on the Bagshots of the western part of the London Basin; Dr. Irving and Messrs. Monckton and Herries distinguished themselves in this connexion. Prof. Prestwich contributed an important paper on the correlation of the Eocene strata in England, Belgium, and the North of France, and Mr. Starkie Gardner, with the assistance of Messrs. Keeping and Monckton, contributed a very useful paper on the Upper Eocene, comprising the Barton and Upper Bagshot formations.

Under the heading of Tertiary Geology it will be convenient also to consider certain oceanic deposits in the West Indies and elsewhere, with more particular reference to the island of Barbados.

The papers on *Cretaceous Geology*, including some specially devoted to palæontological subjects, are about nine in number, and among these are memoirs by Messrs. Jukes-Browne, William Hill, and Lamplugh, which will require to be considered in some detail.

There have been about fifteen papers on *Jurassic Geology*, including the *Rhætic*. Most of these relate to English localities, and a few are purely palæontological. The correlation of the Upper Jurassic strata of the Swiss Jura with those of England was a valuable contribution from the late Thomas Roberts, of the Woodwardian Museum. There is also an important paper by Mr. S. S. Buckman on the Cotteswold, Midford, and Yeovil Sands, and contributions from other well-known authors, to some of which I hope to be able to draw your attention with more detail subsequently.

It might have been surmised that there was not much left to say on the *Triassic* and *Permian* formations. Yet we have had eight papers, including one by Mr. Wilson on the Durham Salt district, and a very interesting paper by Mr. Horace T. Brown on the Permian rocks of the Leicestershire Coal-field; while Messrs. Irving and Hull have given us their views on the Red Rocks of

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Devon. Perhaps I may find time to expand this subject a little and therewith conclude the present Address.

Of the other subjects brought before the Society there is one of considerable importance with which I shall not venture to meddle, viz. *Vertebrate Palæontology*. In this branch of science there have been between fifty and sixty papers published in the Quarterly Journal, some of which are rather short. Messrs. Seeley and Lydekker have been the most prolific authors, although Messrs. Huxley, Hulke, and Smith Woodward have also contributed valuable papers. It is interesting to bear in mind that Sir Richard Owen sent his last contribution to the Society in November 1886. The President on that occasion expressed his regret that the Author, owing to his illness, could not attend the Meeting, and thus reply to criticisms on the systematic position of *Galesaurus* and the geological age of the beds in which it occurs.

The subjects, then, for special consideration on the present occasion include *Pleistocene*, *Tertiary*, *Cretaceous*, *Jurassic*, and possibly *Triassic* and *Permian Geology*.

Pleistocene Geology.

Some of the papers placed in this category might perhaps have been grouped under Vertebrate Palæontology, such as that by Mr. Fisher on '*Elephas meridionalis* at Dewlish' and a few others; but these papers are certainly required to illustrate the subject of Pleistocene Geology. On the other hand, seeing that the most important factor in Pleistocene Geology was the Glacial Period or Great Ice Age, it will be convenient to consider by way of an appendix to this heading a certain number of papers dealing with the question of glacial climates, etc., from a more or less theoretical point of view.

When these additions are made, there will have been upwards of forty papers on the subjects now under consideration. Of these the most important, perhaps, was the memoir by Prof. Prestwich 'On the Westleton Beds,' which the Author found it convenient to divide into three parts. Prof. Prestwich has also contributed other papers of considerable magnitude in connexion with Pleistocene Geology. A large proportion of the papers read by authors relate to the South-east and the South of England; and in the latter case especially the phenomena of districts not themselves glaciated have received considerable attention. Approaching nearer the sources of glaciation, we have a useful paper by Mr. Deeley on the Pleistocene succession

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in the Trent basin, and several authors have written on North Wales and the Border districts. The north has yielded few papers, but we have one of considerable importance on the Drifts of Flamborough Head by Mr. Lamplugh, and there is a paper by Mr. Kilroe on the direction of the ice-flow in the North of Ireland. Lastly, Mr. Jamieson has contributed some supplementary remarks on the Parallel Roads of Glen Roy.

In making a division of the subject, the South-east and South of England are naturally the first areas to claim our attention. Owing to the number of communications and the varied character of the phenomena described, the arrangement of this large amount of matter is by no means an easy task. To attempt anything in the nature of a chronological classification would seem to be like offering the Apple of Discord at the very outset, since few are agreed as to the precise value of the words 'post-glacial,' 'glacial,' and 'pre-glacial.' We may indeed adopt a common-sense interpretation, partly suggested by Prof. Prestwich, that 'post-glacial' means the time during which the cold was diminishing, 'glacial' the time when it was at its height, and 'pre-glacial' the time during which the cold was increasing. It must be obvious to all that no sound chronological arrangement can be based on these divisions, since 'glacial' conditions may easily have prevailed in some parts of our island and 'post-glacial' in others, more or less contemporaneously.

The divisions then which I propose to adopt are in the main topographical, and include the South-east of England, the South of England, Central England and North Wales, East Yorkshire, and the North of England and Scotland.

South-east of England.—In many parts of this district the Chalky Boulder-clay acts as a guide to a certain extent, and we can at least say in these cases whether a deposit is above or below the Boulder-clay. With this proviso I would draw attention to a paper by Mr. Candler on the Lacustrine Deposits of St. Cross. This place is situated within the drainage of the Waveney, the beds lying in a hollow of the Boulder-clay towards the northern edge of the plateau of Suffolk. The lacustrine beds themselves now occupy a ridge between two depressions, the valleys having been deeply eroded since the filling-up of the lake. The fauna and flora of such a deposit are interesting from the fact that there can be no doubt whatever of their marking a period subsequent to the deposition of the Boulder-clay of East Anglia, and though somewhat remote in time from that deposit, a considerable amount of denudation has

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been effected subsequently. Hence we may call it 'post-glacial' as far as that district is concerned, although glacial conditions most likely still prevailed in the mountainous regions of the north and north-west. The uppermost beds were found to contain *Elephas* (? *primigenius*), *Equus caballus*, *Bos taurus*, var. *primigenius*, *Cervus*, sp., and *Arvicola*, sp. Below this was a loam with seeds and shells. There was nothing especially Arctic in the plants, which were mainly of marsh- and aquatic species; but the discovery, due to Mr. Clement Reid, of the hawthorn as a fossil for the first time in Britain was a fact of considerable interest.

Of approximately the same age as the St. Cross beds are those now celebrated deposits in Endsleigh Street, where Dr. Hicks last year discovered the remains of Mammoth, associated, as at St. Cross, with the bones of Deer, Horse, and Vole. In this case also the accompanying flora contained no typically Arctic plants, but such as extend at the present time from the Arctic Circle to the South of Europe. That the climate, even in the Thames Valley, was then cold the Author had no doubt, and he observed that farther north the conditions were such as are considered, in part at least, characteristic of the Glacial period. The most natural inference from these statements and from the known facts of the case is that the Endsleigh Street deposits are of early 'post-glacial' age. Dr. Hicks, however, felt sure that the beds above the mammaliferous loam cannot be classed as post-glacial river-deposits, and he rather favoured the notion that they might be an extension of the Chalky Boulder-clay of the higher grounds, an opinion not justified by any marked lithological similarity.

There are about half a dozen papers which deal with the Boulder-clay and Northern Drift of South-eastern England, north of the Thames. Mr. Rowe, in describing the rocks of the Essex Drift, comments on the absence of granite, while quartz-porphyrites and felspar-porphyrites, as he calls them, are abundant; but the most plentiful rocks are the dolerites, some of which resemble the whin-sill, whereas the basalts are stated to be like those of Scandinavia. The sandstones are chiefly of Carboniferous age, but there are some from the Spilsby Beds of South Lincolnshire, such as are known to be abundant in the Boulder-clay of West Norfolk. Most of the limestones belong to the Jurassic Series.

How far this Author is correct in assuming the basalts of the Essex Drift to be like those of Scandinavia may be regarded as an open question. There has been a laudable desire for some years

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past to find boulders of Scandinavian origin in Eastern England. The Rhomben-porphyr of the neighbourhood of Christiania, for instance, has been fairly identified as an erratic on the coast near Cromer. Very recently a member of the Danish Geological Survey obtained three specimens of boulders in the same district, of which one was thought to have come from the south of Norway and the other two from so remote a district as Dalecarlia: they were either felspar- or felsite-porphyries. The subject of Scandinavian boulders has been likewise discussed by Mr. Lamplugh in his paper on the Drifts of Flamborough Head, where he quotes Mr. Harker to the effect that the bulk of the granitic and gneissic specimens might have been derived from Scandinavia or from the Scottish Highlands. Among them are some undoubted Norwegian rocks, while none can be pointed out as certainly brought from Scotland: it may well be, then, that the whole of the doubtful rocks are also of Norwegian origin. The granite-and-gneiss group of Flamborough, according to Mr. Lamplugh, amounts to between 3 and 4 per cent. of the boulders at that spot. If one might venture to make a remark on this subject, it would seem that the felspar- and felsite-porphyries, rather than the granites and the gneisses, are the most likely rocks to survive the long journey across the North Sea.

One of the most curious facts in connexion with Northern Drift is the discovery, narrated by Mr. Whitaker, of a deep channel of Drift in the valley of the Cam, also in Essex. The Drift here is said to consist mostly of loam or sand more or less bedded, together with clay (sometimes apparently a Boulder-clay full of pieces of chalk) and gravel. At Newport occurs the greatest thickness of Drift hitherto recorded in the South-east of England. In one case a boring of 340 feet, being 140 feet below the level of the sea, failed to reach the bottom of this curious rift in the Chalk. In this case we seem to be dealing mainly with beds below the great sheet of Boulder-clay, and thus the chief interest in these singular discoveries centres in a period anterior to the deposition of that formation.

The Rev. Edwin Hill drew attention to some features of the Boulder-clay of the adjoining district of West Suffolk, inferring that it must contain within its mass pervious beds or seams of some different material, and consequently that it is not a uniform or homogeneous mass. From the above considerations he argued that this Boulder-clay could not be the product of the attrition between an ice-sheet and its bed—a conclusion on the part of the Author apparently not shared by the majority of those present at the reading of his paper.

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Coming nearer home, there are two papers relating to Glacial deposits in the Thames basin, which raise questions of considerable interest. That by Dr. Hicks on some recently-exposed sections in the Glacial deposits at Hendon relates mainly to beds below the Chalky Boulder-clay. But he observes that recently, on the Finchley and Hendon side of the Brent Valley, there is good evidence that Boulder-clay extends considerably below the 200-feet contour-line, and it sometimes reaches downwards through the underlying Drifts until it has completely penetrated them and touched the London Clay floor. It is these underlying Drifts which are of such extreme interest in that district. The view originally expressed by Dr. Hicks that the sands and gravels at and near Hendon should be classed with the so-called Middle Sands and Gravels of the Eastern Counties is now, the Author says, generally adopted. It is well within the recollection of many of the Fellows that our Secretary successfully conducted a large party of geologists over these sections in April last. The singular appearance of a mass, consisting mainly of reconstructed London Clay, sandwiched, as it were, between an upper and a lower gravelly series, will not be readily forgotten by those who were able to verify the sequence. These deposits reach downwards on the slopes below the 200-feet contour, and it is thought that they may be traced on other heights in N.W. Middlesex. The Author also considers that the implement-bearing deposits on the higher horizons in the Thames Valley should be classed as of contemporaneous age with these undoubted Glacial deposits at Hendon and Finchley, which they so closely resemble. It would be more to the point, however, to find palæolithic implements in these latter.

Still more conclusive evidence as to the existence of low ground in what is now the basin of the Thames was adduced by Mr. Holmes in his paper on the new railway from Grays Thurrock to Romford. In the Hornchurch cutting 15 feet of Boulder-clay was seen to rest directly upon the London Clay near the 100-feet contour-line. This Boulder-clay is overlain by about 12 feet of sands and gravels, which, if we take the Boulder-clay as the time test, are locally post-glacial. It is in all respects a typical deposit, such as commonly occurs in Essex. Except in this cutting, we are told, Boulder-clay has never been seen in conjunction with the overlying deposits of the Thames Valley, either north of Romford or in the neighbourhood of Finchley and Hendon, the most southerly spots where it has hitherto been known to occur.

The great series of papers by Prof. Prestwich on the Westleton

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Beds relates to deposits below the East Anglian Boulder-clay. The first part deals more especially with the sections on the coasts of Norfolk and Suffolk, and the second with the range inland of the Westleton Beds or their presumed equivalents; the third part, relating chiefly to the Southern Drift, belongs to another category.

It is well known to students of geology that the classification of the variable series of beds which lie between the undoubted Pliocene and the Chalky Boulder-clay in Norfolk and Suffolk has exercised the faculties of observers in East Anglia for a long period of time. There are few subjects, indeed, which have been more fruitful of divergent opinion. No one can doubt the importance of these beds, for they contain the key to the history of the first half of Pleistocene time in this country. Prof. Prestwich, in describing the relationship of this group to the Crag Series below and the Glacial Series above, while he admits the value of the distinction drawn by Messrs. Wood and Harmer between the Norwich Crag and the Bure Valley Pebble-beds, does not think that either the palæontological or stratigraphical proofs respecting the position of these Pebbly Sands are so well defined in the Bure Valley district as they are in the Westleton and Southwold districts, or so fitted to be taken as the type of a widespread geological zone.

It is not very easy to understand the duplicate character of the 'Westleton Beds.' However, we learn that on Westleton Common a general section shows about 50 feet of sandy shingle or pebbly sands without fossils. At Mundesley about half that thickness of variable gravels, sands, and clays occasionally fossiliferous, represents the series, which on the Norfolk coast is held to consist of the Arctic Freshwater Bed of Reid, the *Leda myalis*-bed of King and Reid, and the Upper Freshwater Bed of Reid.

Since the Pebbly Sands at Westleton are themselves unfossiliferous, a difficulty occurs at the outset. It was, in fact, pointed out that although the name Mundesley Beds might be a useful local term for the series immediately above the Forest-bed, yet, if the term Westleton Beds was associated with them, it might turn out in the end that there were no 'Westleton Beds' at Westleton. As regards the above grouping, Mr. Reid objected to his Upper Freshwater Bed being merged in the Westleton or Mundesley Series, giving reasons for his having included it with the Forest-bed group. As to classing the Arctic Freshwater Bed with this one, he noted that the floras showed a difference of climate amounting to 20° F., and thus he considered the grouping of the two unadvisable.

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The Westleton Beds, as above defined, were found to rest unconformably on various underlying beds: in places on the Forest-bed Series, elsewhere on the Chillesford Clay, while occasionally the latter had been partly or entirely eroded before the deposition of the Westleton Beds. A similar discordance has been noted between the Westleton Beds and the overlying Glacial deposits, so that the former mark a distinct period, characterized by a definite fauna and by particular physical conditions. In spite of the discordance above mentioned, Prof. Prestwich is prepared to claim the Forest-bed as part of the Westleton Series, if the former should prove to be newer than the Chillesford Beds. The Westleton Beds being marine, and the Mundesley Beds estuarine and freshwater, that author proposed to use the double term to indicate the two facies. But these two facies were found to be local, and the most persistent feature of the beds is the presence of a shingle of precisely the same character over a very wide area. By means of this shingle the Westleton Beds may be identified far beyond East Anglia. Moreover, unlike the Glacial deposits, they contain pebbles of southern origin.

In tracing the Westleton Beds, or their presumed equivalents, from the East Coast to the Berkshire Downs, they are seen to rise from sea-level to heights of 600 feet, in the first instance underlying all the Glacial deposits, and in the second rising high above them, so that their seeming subordination to the Glacial Series altogether disappears. At Braintree, for instance, where the Westleton Beds are largely developed, they stand up through the Boulder-clay and gravel which wraps round their base; while farther west, where they become diminished to mere shingle-beds, they attain heights of 350 to 400 feet, capping London Clay hills, where the Boulder-clay lies from 80 to 100 feet lower down the slope, the difference in level between the two deposits becoming still greater in a westerly direction, until finally the Boulder-clay disappears. A plate of diagram-sections serves to illustrate these views, and we thus see how the Pebbly Series of East Anglia, for the most part at slight elevations and covered by Boulder-clay in Essex, gets higher and thinner and more widely separated until it becomes a mere hill-gravel. As such it is found capping isolated eminences, 370 feet above Ordnance datum at Highbeach, 400 feet at Totteridge on the opposite side of the Lea, and 600 feet on more than one point of the Chilterns, where this Pebbly Series has been the means of preserving small outliers of the Tertiaries.

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Since the identification of the Westleton shingle at points so wide apart seems mainly based on lithological grounds, it is important to notice its distinctive features. Prof. Prestwich states that this shingle consists of drifts from the south and south-east. The flint-pebbles were derived from shingle-beds of Tertiary age in Belgium, the North of France, and Kent; the quartz-pebbles directly or indirectly from the Ardennes; the subangular flints directly from the Chalk or from an older Drift; chert and ragstone from the Lower Greensand of Kent and Surrey, or indirectly from the Southern Drift. The marine nature of the beds is inferred from the included fossils of the type-area, and the absence of these elsewhere is accounted for by decalcification. With reference to this point, it may be as well to remember that the Westleton Beds on Westleton Common are unfossiliferous, and that the Mundesley facies of this series is mainly freshwater.

In conclusion, Prof. Prestwich states his belief that the Westleton shingle must have been formed on a comparatively level sea-floo throughout the area over which its outliers extend, and that the irregularities in distribution have been produced by subsequent differential elevatory movements. He gave a diagram-section across the Thames at Goring, which yields a means for estimating the amount of earth-sculpture effected there since the presumed equivalents of the Westleton shingle were continuous from side to side of the valley. He thus arrives at the conclusion that the deepening of the gorge amounted to about 160 feet during the early Glacial Period, to 220 feet during the later Glacial Period, and to 70 feet during the post-Glacial Period. Surely this amount of work is scarcely in accordance with the moderate limits which, in another paper, he is disposed to assign to the entire Glacial Period.

The last paper which it seems necessary to notice in connexion with the Pleistocene Geology of the South-east of England is one by Mr. E. T. Newton on the Cetacea of the Norfolk Forest-bed. He identified the Sperm Whale and a species of *Balæna* which is most probably *B. biscayensis*. Of other vertebræ from the Forest-bed one was referred to *Balæna* and another to *Balænoptera*. This collection was regarded as a fair epitome of the Cetaceans now inhabiting British seas, since it contained examples of all the leading types, while curiously enough the large land Mammals of the Forest-bed are said to be extinct. Under these circumstances, and bearing in mind how differently the Cetacea are represented in the true Crags, it seems only natural to regard the Forest-bed as a local phase of the

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Pleistocene succession. Indeed, as we have already seen, Prof. Prestwich under a certain contingency threatens to incorporate it with his Westleton Beds.

The South of England.—After we cross the Thames there is no longer a Boulder-clay of northern origin to supply a sort of rough chronology to the various drifts of this region, which we speak of as not having been glaciated in the ordinary sense of the term. Hence the problems connected with these various drifts, mostly perhaps of Pleistocene age, but some possibly yet more ancient, are especially difficult of solution.

Here again we follow Prof. Prestwich, who, in the third part of his great paper on the Westleton Beds, discusses the subject of a Southern Drift. The character and composition of this Drift have long been known to geologists through the writings of Prof. Rupert Jones, and, more recently, of Dr. Irving and others. It is satisfactory to find that on these points there is but little difference of opinion. The Southern Drift is said to differ from the Westleton Beds in a deficiency of pebbles of old-rock origin, while on the other hand it is characterized by a large proportion of chert and ragstone—not that these are wanting in the Westleton shingle, but they are in less abundance, more reduced in size, and hold a more subordinate position. The materials common to both, but present in different proportions, are subangular flints and flint-pebbles.

The Southern Drift or Hill-gravels are then traced from Kent into Berkshire; in the east they repose mainly on the Chalk, in the west on the Tertiaries. Owing to the absence of organic remains we are without a clue as to whether their origin was fluviatile or marine. Prof. Prestwich thinks it not improbable that they are of subaerial origin, possibly 'fans' such as are carried down by torrents. It is also possible that the cone may have discharged under water, thus spreading out to a greater extent and more uniformly, and with the rough sort of bedding this gravel sometimes shows. Such an origin implies something like a mountain-range in the direction of the Weald, the consideration of which might take us too far outside the limits of Pleistocene Geology. It is sufficient to say that the Author believes the Southern Drift to be somewhat older than the Westleton shingle, but that the two must at one time have proceeded synchronously. Hence the Southern Drift may range from late Tertiary to early Pleistocene times. This is as much as to say that they are pre-glacial in a certain sense. Dr. Irving thinks that the chief evidence of glacia-

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tion occurs at lower levels, and that the deposition of the Plateau-gravels covers most of the geological time represented by the Pliocene.

Stimulated by the example of Prof. Prestwich, Mr. Monckton has lately studied with much attention the gravels on the south side of the Thames from Guildford to Newbury. He concludes that the greater part of the hill-gravels belongs to the Southern Drift of Prestwich, and that the valley-gravels mostly consist of material derived from the Southern Drift. Small patches of what he identifies as Westleton shingle and Glacial gravel occur near Reading and Twyford. He divides the Southern Drift into three classes, of which the oldest is probably the Upper Hale type, characterized by the abundance of small quartz-pebbles and the scarcity of chert. The gravels of Chobham Ridges and Silchester, though differing as to the amount of quartz-pebbles and chert, were probably nearly contemporaneous. He rejects the theory of marine action.

The entire subject of the hill- or plateau-gravels south of the Thames is indeed full of difficulty, but there does seem a preponderance of opinion in favour of their freshwater origin, including ice to a certain extent in that category. These gravels may or may not have been continuous, though the elongated shape of many of the patches is thought to afford an indication, in some cases, of fluviatile origin. Such patches are certainly answerable for many of the existing hills in the soft Tertiary districts of West Surrey and East Berks. Of course, as the valleys were excavated or deepened, much of the gravelly material originally on the plateau would remain on the flanks, either as irregular deposits or imperfect terraces. This is an almost self-evident proposition, and the principal question for decision relates to the period when these events occurred.

Some answer to this question may be sought in another paper by the indefatigable Prof. Prestwich on the Drift stages of the Darent Valley, where he observes that the first indent of that valley must have been subsequent to the deposition of the Lenham Sands (earliest Pliocene) and even of the Red Clay-with-flints. In early Pliocene times a plain of marine denudation was shown to extend over the valley of Holmesdale, and in pre-glacial times the valley was scored by streams flowing from the high, central Wealden ranges. The streams centred in the Darent and the excavation of the present valley then commenced. The Author believes there is a gap between the pre-glacial drifts of that district and the earliest post-glacial drifts of the valley, a gap which might perhaps be covered by the epoch of extreme glaciation. The paper last quoted was to a certain

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extent supplementary to that on the Palæolithic Flint-implements at Ightham. The anthropological questions raised in this remarkable paper I do not venture to discuss, but there also the Author insists that the high-level deposits were formed anteriorly to what he calls the post-glacial drifts of the Thames and Medway, the deposits on the Chalk-plateau being abruptly cut off by the river-valleys.

Shifting the venue now to the south side of the Weald, comprising the basins of the Arun, Adur, Ouse, and Cuckmere, we have the testimony of Mr. Elsden, who observes that the angular-flint drift occurs mainly on the higher parts of the district and is wanting in the river-valleys, where river-gravels derived from the denudation of older deposits are abundantly developed. Not only in the Wealden area, he continues, but in many of the neighbouring districts, the angular-flint drift consists of the undenuded remnants of a deposit formed before the present river-valleys were excavated: many of the river-gravels, though newer than the angular drift, were deposited when the valleys were less deep. He considered that Mr. Searles Wood's marine theory of the origin of these gravels was refuted by their mode of occurrence.

If time and the necessity of dealing with other subjects permitted, it would be interesting to touch on some of the questions raised by Prof. Prestwich's last paper 'On the Head or Rubble Drift of the South of England.' There are also two papers by Mr. Clement Reid relating to the Pleistocene Geology of Sussex. His suggestion as to the origin of Coombe Rock seems very natural. It is quite possible that the cold *in winter* during all three phases of the Glacial epoch may have been as severe in the South of England as in the most glaciated regions of the northern part of these islands. Such being the case, the ground would be frozen to a considerable depth, and the drainage-system of the Chalk more or less modified. The summer rains would run off any steep slope, tearing up the layer of rubble already loosened by frost, and carrying down masses of Chalk too rapidly for solvents to have much effect. A similar suggestion with reference to certain deposits in connexion with the Yorkshire Wolds has been made by the Rev. E. M. Cole and Mr. Lamplugh. The submergence shown by the marine beach at Goodwood, 130 feet above sea-level, is stated to have occurred before the deposit of Coombe Rock. Mr. Reid's investigations, as narrated in a second paper, tended also to show that erratics on the Sussex coast have, in some cases, travelled from the west or south.

Dorsetshire is the next county which claims our attention in

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considering the Pleistocene history of the South of England. It so happened that as long ago as 1813 some Elephant's teeth were discovered near Dewlish, a village in the hilly Chalk country which lies between Blandford and Dorchester. These found their way into the Blackmore Museum at Salisbury, and were generally regarded as the teeth of *Elephas meridionalis*. It is a somewhat curious instance of prejudice on the part of an eminent palæontologist that the late Dr. Leith Adams could not bring himself to allow that these remains belonged to the Cromer Forest-bed species, simply because that species had never been found so far to the westward. Accepting the general palæontological determination as the true one, Mr. Fisher and Mr. Mansel-Pleydell set to work, two or three years ago, to investigate the locality, and their efforts were rewarded by finding further traces of *Elephas meridionalis* on the same spot.

Inferences of considerable geological interest may possibly be drawn from this discovery, if we admit that the species is rightly determined. Whether we regard the Forest-bed series as Pliocene or Pleistocene is merely a question of detail, as to where a line should be drawn. But it seems only reasonable to suppose that the deposit at Dewlish is approximately of the same age, though no doubt the confirmation of an associated fauna would be desirable. Such being the case, the history of a deposit like this, if successfully worked out, might yield important evidence in relation to the sculpture of the district and to the period during or since which it has been effected. In this way also we might find some means for testing the conclusions of Prestwich with regard to the presumed inland equivalents of his Westleton Beds, and the events which he believes to have happened since they were laid down.

The Authors in the first instance concluded that the deposit at Dewlish had been water-borne, and that it had been undercut into the face of the escarpment, which is very steep at that spot, rising about 100 feet above the bottom of the valley. Had this been the correct inference, it was evident that the valley had been deepened to the extent of some 90 feet since the Elephant-remains were deposited. But further investigation has convinced Mr. Mansel-Pleydell that this reading, as represented in the section accompanying the paper, is not the true one. The deposit, in fact, lies in a kind of narrow fissure, which is situated on the brow of the escarpment, almost at right angles to the trend of the valley itself. It would seem, therefore, that the deposit is altogether independent of the present gorge, and may possibly be older than its initiation,

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though the evidence on this point requires further working out. Altogether, since the new reading, the evidence as to the amount of sculpture effected in the immediate neighbourhood posterior to the deposit of the Elephant-remains is not of so decided a character as under the old hypothesis.[1]

Central England and North Wales.—We must now turn from the Pleistocene Geology of the southern counties to the more certain evidences of glacial action in the North Midlands. In this connexion we have a paper by Mr. Deeley on the Pleistocene succession in the Trent basin, more especially in the vicinity of the junction of the Derwent with that river. As the outcome of seven years of careful observation from 1879 to 1886, this paper should carry some weight with it. The Pleistocene deposits of the Trent basin are, he says, chiefly remarkable for the great development which the Glacial beds attain; these consist of Boulder-clays, gravels, and sands of various kinds and ages. The distribution of Boulder-clay varies much, both as regards age and thickness, for in some localities it occurs in great masses occupying small areas, and in others it covers considerable districts with a tolerably uniform mantle.

In the Trent basin, as in that of the Thames, the Older Pleistocene deposits are distinguished from those of later age by their freedom from Cretaceous rock-débris. This Older Pleistocene consists of two Boulder-clays separated by a quartzose sand. These Pennine Boulder-clays, as Mr. Deeley calls them, are composed of materials derived almost entirely from the Derbyshire highlands, with a slight admixture to the westward of erratics from Scotland and elsewhere. The bulk of the materials were transported from the Pennine chain by glaciers, and deposited in what he regards as the partially submerged valley of the Trent. "The conditions of climate which gave rise to the formation of the early Pennine glaciers, and which passed away with the increasing submergence of the Quartzose-sand sea, again returned; for upon the Quartzose sand there are thick deposits of Boulder-clay, giving evidence of intense glacial conditions." I have quoted this last passage *verbatim*, as it shows the

[1] The following is an extract from a letter written to me by Mr. Mansel-Pleydell on this subject last autumn:—'Perhaps you will kindly add a note to your remarks upon the Dewlish bed, namely, that my paper in the Proceedings of the Dorset Field Club was written before I had traced it from end to end. Instead of its being a pocket at a higher level than that of the present stream, as I supposed, it is a fissure in the Chalk into which the Elephant-remains, flints, etc., fell in as the Pliocene (?) stream passed over it, and of which no other evidence is left.'

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impression of the Author that the Quartzose sand is marine, and that it indicates an intermittence of the cold—suppositions which seem to be due to ideas then prevailing rather than to any positive proof, since there is no mention of any fossils.

Coming next to the Middle Pleistocene deposits, he regards the Great Chalky Boulder-clay in the Trent basin as chiefly a ground-moraine, though in places it presents indications of an aqueous origin. This also is underlain by a sand known as the Melton Sand, in which detritus of Cretaceous age first appears in abundance, and here again, according to the views of the Author, there is a suspicion of a milder climate. The Pennine rocks in this Boulder-clay he thinks were derived from the Older Pleistocene deposits over which the ice passed. This view necessitates an extraordinary want of activity on the part of the Pennine glaciers, during the very culmination of the Glacial Period, which is not easy to account for. Consequently he calls in the aid of a depression in the Pennine axis, which would admit the approach of Continental ice without interference from local English glaciers. In a recent communication to the 'Geological Magazine' for 1893, p. 33, he appears to hold the same view; for he considers that the only way of accounting for this absence of local glaciers, while the Scandinavian ice-sheet advanced over the country, must be based on the assumption that it occurred during a period of submergence. He admits that the present opposition to such a view is very strong, though possibly based on inadequate grounds. In West Staffordshire, Mr. Deeley considers that the entire Middle Pleistocene deposits are probably represented by gravels and sands, and it is noteworthy that in this area fragments of marine mollusca are stated to be of frequent occurrence.

In the Newer Pleistocene, according to Mr. Deeley, there was a re-elevation of the Pennine chain and of the Trent Valley, thus apparently producing a change in the direction from which the materials of the deposits were derived; and a river-gravel which he regards as interglacial now occupies terraces at various heights along the valley of the Trent and its tributaries. This was succeeded by the later Pennine Boulder-clay stage, which marks the return of local ice-action. He observes that whilst the Older Pleistocene Boulder-clays are partly sedimentary, these later deposits are almost entirely unstratified, and when pebbles and boulders occur a fair proportion of them are flint. In many cases, he says, it is scarcely correct to call this moraine a Boulder-clay, for

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it is occasionally quite free from clay, consisting of gravel and sand so disturbed that all traces of original stratification, if ever they existed, have been destroyed. All the Boulder-clays and gravels from the early Pennine down to the 'Interglacial River-gravel' have been crushed at the surface, or even partially converted into newer Boulder-clay.

Crossing the Cheshire plain, we must now follow Messrs. Strahan, Hughes, and Hicks in their descriptions of some of the Pleistocene phenomena of North Wales and its borders. The first-named Author tells us that in the neighbourhood of Liverpool the materials of the Drift have travelled from the N.W., and that the edges of the strata have in many cases been bent back also from the N.W., the same agent which distributed the Boulder-clay having presumably striated the rock-surface. On the Welsh border the striations are said to show a general parallelism, as though the direction of the movement of the Drift was from the W.S.W., and the transportation of much of this Drift has taken place across the lines of the principal hill-ranges and valleys. It would seem that in a valley such as that of the Dee, which is in part conformable to the mean direction of the movement, this is less evident than in the valley of the Clwyd, which seems to have been crossed almost at right angles to its axis. The line of demarcation of these two partly opposing Drifts is shown on a map.

When Mr. Strahan discussed the merits of the rival hypotheses, firstly of two ice-sheets moving in different directions, and secondly the agency of floating ice, he was (at that time) in favour of the latter view, concluding that the marine drifts and their striations were produced by floating ice during a period of submergence. Amongst his reasons for thus deciding, he pointed out that the rock-surface is not 'moutonnée' on a large scale, and that the striæ and terminal curvature are far from being universal; and he further observes that the marine origin of the drifts is indicated by their well-marked stratification, as a whole, and by the occurrence throughout all the beds of marine shells. Some of these arguments may be good, but it has always seemed to me that anything approaching to parallelism in a system of striations could only be effected by an agent moving more or less in one direction, which is hardly what we should expect of floating ice, subject to the irregularities of winds and currents, even supposing that floating ice is capable of rock-grooving on a large scale. I venture to make these comments, because the views then advocated by Mr. Strahan seem to represent

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the belief of that school of geologists which seeks in submergence and the direct action of the sea for a true explanation of these phenomena.

But whatever theories as to origin we may adopt, the leading factor in the Pleistocene history of this region is the existence of two drifts, viz. the Welsh or Arenig Drift, and the Northern or Irish Sea Drift. Prof. Hughes has traced the Arenig or Great Ice Drift, as he calls it, from the Snowdon and Arenig ranges by the striæ on the solid rocks and by the included fragments. It is described as consisting of Boulder-clay and striated boulders, all of indigenous origin, and contains no shells. In his classification of the drifts of the Vale of Clwyd, this drift is placed at the base of the system, but Dr. Hicks was of opinion that the Welsh or Arenig Drift is not necessarily the oldest. In some places it may even be the newest, as it is known from well-sinkings to be underlain by sands and gravels in which bones of animals similar to those found in the caverns were discovered. The explanation of this divergence of opinion seems to be that the indigenous Drift both underlies and overlies the Drift of the Irish Sea, as might very well be the case where the two inosculate, just as in Derbyshire there is a local Boulder-clay both older and newer than the Middle Pleistocene Chalky Boulder-clay.

The following is an abstract of the views expressed by the late Prof. Carvill Lewis when the paper on the Drifts of the Vale of Clwyd was read. He maintained that there had been "three main areas of local glacial dispersion in Wales, the glaciers from each of these being defined by terminal moraines. But there was also satisfactory evidence that an ice-lobe coming from Scotland [reinforced by Cumbrian and North Irish ice] and filling the Irish Sea had impinged upon the extreme northern border of Wales, and passing over Anglesey and along the west of the Snowdonian mountains on the one side, and into Cheshire and along the east of the mountains on the other side, had pushed its terminal moraine against the highlands and in the teeth of the opposing local glaciers. The latter were both earlier and later than the northern ice-lobe, and the two Drifts were therefore often commingled. The line dividing the northern ice-lobe from the Snowdonian glaciers was close to the Cae Gwyn cave, and the massive deposits near St. Asaph were probably washed out of the common terminal moraine." "The undoubted marine deposits," he continued, "full of shells, which cover the lowlands of Lancashire up to 150 feet above the sea, also

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extended up the Vale of Clwyd to the same level; but much of the stratified material in that valley was remanié." He spoke of "torrential freshwater action, operating during the melting of the ice, as an important factor not to be omitted in studying valley-gravel."

One of the chief points in dispute on this as on a subsequent occasion, when Dr. Hicks read a paper on the Cae Gwyn cave, referred to the precise age of the bone-earth at the bottom of that cave, the mouth of which is 400 feet above sea-level. Dr. Hick maintained there was no foundation for the view that the drift, which covered up the entrance and extended into the cavern, was remanié. He claimed that the deposits which lay over the bone-earth were *in situ* and were identical with the normal Glacial deposits of the area, and that the cavern had been completely buried in them. These drifts Mr. Strahan believed were part of the Northern Drift which he had mapped over a large portion of Denbighshire, Flintshire, and Cheshire. On the whole, it must be admitted that the testimony of the majority of geologists was in favour of the view that this bone-earth, with its peculiar fauna, so different from that of the post-Glacial fauna of the vicinity (Morton), and bearing a certain resemblance to the Forest-bed fauna, has been sealed up by a Drift, which is most probably that derived from the Irish Sea, and which, if we accept its glacial origin, represents in all probability the most severe period of the Great Ice Age. How much older the bone-earth may be than this Drift it is not easy to say, but appearances are certainly in favour of its being early Glacial. The point is one of considerable interest, because of the associated Palæolithic implements; but into this part of the controversy I do not venture to enter.

The question of the glacial origin of the Drift of the Irish Sea is one of more importance from a geological point of view, and it bears also on some of the points brought forwards in the Cae Gwyn discussion. It was alleged, for instance, that the sea during the great submergence would have washed all the bone-earth and its contents out of the cave, on the supposition that those contents were of early Glacial age. But if the sea never reached the mouth of the cavern, as the opponents of the Great Submergence hypothesis might allege, this difficulty at once disappears.

In this connexion there is a paper by Mr. A. C. Nicholson, 'On the high-level Glacial Gravels at Gloppa, near Oswestry,' which raises the same questions that have been so often discussed with reference

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to Moel Tryfaen. These gravels occur on the eastern slope of the ridge of Carboniferous rocks, here represented by Millstone Grit, which forms the western boundary of the Shropshire and Cheshire plain. The main mass of the gravels at Gloppa is comprised in a ridge of eskers, about 1000 yards long and ranging from 900 to 1160 feet above sea-level. The beds present the appearance of having been abruptly cut off on the north-eastern slope, the greatest depth exposed being about 60 feet. The upper layers seem to be sufficiently argillaceous to have prevented the percolation of water, and the gravels themselves are in places much contorted and current-bedded. Among the boulders are granites like those of Eskdale, Criffel, etc., felspathic traps, Silurian grits and argillites, Carboniferous rocks, Liassic shale, and Chalk flints. England, Ireland, Scotland, and Wales seem to have been requisitioned in order to find materials for this curious deposit. The shells are often broken, rolled, and striated, but the bulk of them are in fairly good condition, so that many species of varying bathymetrical range have been determined. The fauna is like that of Moel Tryfaen, and, as there is a considerable mixture of species belonging to various depths, such an assemblage cannot be regarded as having lived contemporaneously on the spot where the deposit occurs. A large proportion of the shells belong to species frequenting a sandy bottom, and different from those which might be expected on a steep, rocky coast such as would here be exposed to the sea by submergence. The highest point for marine shells at Gloppa is 1120 feet. A similar gravel occurs on Selattyn Hill, two miles to the north along the Millstone Grit ridge, at a height reaching to 1300 feet, but hitherto no shells have been found here, the exposure being small.

More recently Mr. Mellard Reade has again drawn attention to some facts in connexion with the shell-sands on Moel Tryfaen, which have evidently been sorted by water. He points out that they are in fact overlain by typical 'till' composed of local rocks with a small percentage of clay; whereas the sands and gravels are full of erratics, including rocks from Scotland and elsewhere. He still adheres apparently to the hypothesis of submergence to an extent of at least 1400 feet.

There are other geologists of eminence who likewise maintain these views, though in the case of the high-level shell-gravels it is now generally admitted that these are not original marine deposits. The believers in the Great Submergence would ascribe such accumulations to the action of floating ice transported by the waves and

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currents of the sea. A younger and more numerous school of geologists consider that they are the result of the action of glacier-ice, which has actually thrust a portion of the bed of the sea uphill, into positions where the materials have been roughly assorted in the streams and lakelets resulting at various times from the thawing of such ice. This is a considerable demand upon the credence of the older race of geologists, essentially and rightly a conservative body of men. One may venture to say that it is the dynamical question which has been the chief obstacle to the general acceptance of this view; if that part of the problem could be satisfactorily solved, we should accept with thankfulness an explanation which does away with the necessity for belief in the Great Submergence and all the incongruities which that belief involves. Certainly, there is yet a third explanation to which I may make a passing allusion, viz. the possibility of that Great Flood which is to relieve us from the Glacial Nightmare, and thus enable us to get rid of our difficulties. Lyell, in one of his letters,[1] as some of you may remember, speaks of a tour in Wales, where "a certain Trimmer" had found near Snowdon 'crag' shells at the height of 1000 feet, "which Buckland and he convey thither by the Deluge." This, I presume, alludes to Moel Tryfaen, and it is significant that the writers spoke of these remains as 'crag' shells. The Great Flood seems to be a kind of revival of the Noachian Deluge.

In order to satisfy ourselves as to the necessary *vis-a-tergo* required by the ice-thrust hypothesis, we must take into consideration the possible condition of the Irish Sea towards the period of intense glaciation. Some notion of this state of things may be furnished by studying Mr. Kilroe's paper on the direction of the ice-flow in the North of Ireland and the accompanying map. It may be objected that the conclusions of this paper are based mainly on the direction of the striæ, and especially that portions of the map represent what may possibly be regarded as an exaggerated aspect of the case, more particularly in the direction of the Atlantic. Messrs. Peach and Horne, whom the Author follows, extend the margin of their Atlantic ice-sheet to the edge of the 200-fathom line, a distance of about 80 miles from North-western Ireland and the Hebrides, although this is a moderate distance compared with Dr. Croll's estimate. As we are frequently told that if we want to study the phenomena of the Glacial Period we should go to Greenland, I would merely remark that there is nothing taking place in that country at the present

[1] 'Life of Sir Charles Lyell,' vol. i. p. 319.

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day to justify Messrs. Peach and Horne's conception of the west coast of Scotland during the extreme glaciation of our islands. In modern Greenland there is a strip of ice-free land, broader on the west than on the east coast, and possessed of a fairly abundant fauna and flora; and this strip is continuous, except where glaciers actually enter the sea. The recent researches of Lieut. Peary tend to show that such a strip of ice-free land extends even to the hitherto unknown shores of North-eastern Greenland.

But I have been digressing. The point for present consideration is the condition of the shallow Irish Sea and of the glaciers that flowed into it during the great glaciation. If we accept the main conclusions of Mr. Kilroe, we may readily admit that the North Channel leading into the Irish Sea was blocked by the Scottish ice-flow passing over Ulster and Northern Connaught, and that this flow even controlled for a time the glacial system of North-western Ireland. This central snow-field of Ireland is represented as having its axis on the confines of the northern and the western province in a district which is elevated, but by no means lofty; from this axis the striæ indicate a regular movement of the ice in a south-easterly direction towards the Irish Sea. The most direct flow into the Irish Sea would arise out of the glaciers that descended from the southern uplands of Scotland in Galloway and Dumfries-shire, a limited area certainly, and only of moderate elevation, but possibly overridden at times by more northern ice. Lastly there was the Lake District ice streaming in from the north-east. The outlet for these masses of ice must have been in a southerly direction.

Granting these premises, which do not seem unreasonable in the light of modern investigation, although a few years ago we might have hesitated to accept them, there must have been a stupendous crush, the result of contending glaciers, in the shallow basin of the Irish Sea. Some authors assert that this sea was filled from side to side by an ice-stream fully 2000 feet thick, and the heights at which striæ occur in the Isle of Man are adduced in favour of this hypothesis. The power of ice to thrust rocks uphill is also said to be exemplified in that island, where boulders of granite from Granite Mountain have been carried to the summit of South Barule, a rise of over 800 feet in a mile and a half. The comparatively low watershed of the Irish and South Scottish glacier-systems, which are supposed mainly to have fed this mass, appears to be the principal difficulty in assigning such a thickness as 2000 feet to the ice of the Irish Sea. We may, however, believe that in an area of excessive precipitation a very considerable thickness of ice did

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accumulate on these low watersheds, and thus helped to supply the impetus or *vis-a-tergo* which the actually existing watersheds seem barely sufficient to explain.

According to this hypothesis, then, the ice of Ireland, Scotland, and England in combination essayed to force a portion of the bed of the Irish Sea up the flanks of the Welsh highlands, and this attack was to a certain extent parried by the native ice-streams, since it has been remarked that the shell-bearing High-level Glacial Sands have as yet only been found upon the outskirts of the mountainous areas, such as Moel Tryfaen on the west and Gloppa on the east. In its progress southwards there were only two channels for the escape and melting of the ice, viz. St. George's Channel, and the depression represented by the plain of Cheshire and Shropshire. If this be the true explanation, it would seem that this plain must have been filled with ice for some distance up the western flank of the Pennine Chain, since the deposits above Macclesfield in all probability originated in a manner similar to those at Gloppa.

East Yorkshire.—The history of the drifts in this part of England, though sufficiently obscure, does not make quite so large a demand upon our faith, mainly perhaps because the heights traversed by the presumed glacier of the North Sea are not so lofty as in the cases just quoted from the west side of our island. Mr. Lamplugh, after pointing out the importance of the Flamborough promontory as a locality where the connexion between the drift of the hills and that of the plains may be traced, states that he finds himself compelled to dissent from the views expressed a quarter of a century ago in the Quarterly Journal by Messrs. Wood and Rome. In opposition to their hitherto accepted correlation he concludes that the triple division of Hessle Clay, Purple Clay, and Basement Clay may be recognized to a certain extent farther north than Holderness. Moreover, he declares that he no longer has faith in the occurrence of the so-called 'Interglacial Periods.' He claims that in East Yorkshire the glacial deposits attain their greatest development near the coast-line, and that inland from Flamborough they thin away so rapidly that the Chalk often carries nothing more than a scanty covering of clay within a few hundred yards of the edge of the cliff.

Into the details of this remarkable paper we cannot of course enter, but if we accept his main conclusions as deduced from a study of the sections, the following are some of the results at which he arrives. These results constitute a sort of epitome of the history of Pleistocene time within the district.

Starting with the lowest beds, Mr. Lamplugh observes that we

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are met at the very outset by a question of the highest importance. This refers to the so-called 'infra-Glacial' Beds of Sewerby and Speeton. At the former place occurs a buried cliff of Chalk, with fossiliferous beds (containing Mammalia and land and marine Mollusca) banked against it, the whole being surmounted by a more or less complete series of the Glacial Beds. Are these beds, which underlie the Basement Boulder-clay, to be considered as older than the Glacial Period, or are they of inter-Glacial age, formed during an interval between the periods of glaciation? The fauna is rather meagre, though the Elephant-remains hitherto found at Sewerby have been determined as *E. antiquus*. One of the most curious features in connexion with this old beach at Sewerby relates to the pebbles it contains. There is no trace of Mountain Limestone or other recognizable Carboniferous rock, and the inference seems fair that no glaciers from the Pennine Chain reached the east coast at this period. Though there can be little doubt of the ice-borne character of these pebbles, it is not clear whether they have been carried to this beach by floating ice, or have been derived at second hand from an older glacial deposit. The Author is inclined to adopt the former view, and generally contests, throughout the whole of his paper, the notion of an inter-Glacial period. As regards the correlation of his 'infra-Glacial' beds, while admitting that they may not be strictly pre-Glacial, since the district was not likely to be invaded by land-ice until long after the commencement of glacial conditions, he thinks they contain the record of a period anterior to the first glaciation of the east coast, and may be as old as the *Leda myalis*-bed in Norfolk.

Owing to the physical character of the district and its distance from lofty mountains, it may be inferred that a long interval of severe climate ensued before anything like an ice-sheet reached this area. This period would naturally be indicated on the Wolds by subaerial deposits of the nature of disintegrated rock, which would be swept down into the hollows, the action being intensified by the frozen condition of the upper layers of the Chalk. Within the area invaded by the ice-sheet this surface-deposit was not likely to remain undisturbed, but in the inner recesses of the Wolds, never reached by the North Sea ice-sheet, such a deposit has accumulated in high-lying depressions and also in the upper reaches of some of the Wold valleys, where it has remained unmodified. The analogy between such deposits and the Coombe Rock, already referred to, is obvious, though this formation may have been going on throughout a great portion of the Glacial Period.

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We now come to the Basement Boulder-clay, and this, in the Author's opinion, represents the earliest glaciation affecting the eastern side of England. That which is known as the Lower Clay of Flamborough is the northward continuation of the Basement Clay of Holderness. It is now quite clear that, although it includes the scrapings of a boulder-strewn sea-bottom, the clay cannot on this account be reckoned marine. It is essentially the product of land-ice which seems to have crept in upon the land from the north-east. Besides other evidence for the non-existence of earlier glacial beds, Mr. Lamplugh refers to the repeated occurrence of transported masses of Secondary rocks in the Basement Clay, showing that the marine deposits torn up by the ice of that particular period rested upon a platform of Secondary rocks and not upon older glacial beds. Neither transported Secondary rocks nor shelly masses of sea-bottom have yet been observed in any of the higher Boulder-clays. He therefore concurs in the later results of Mr. Wood with respect to the Basement Clay, and regards it as the product of the earlier ('major') glaciation and roughly equivalent to the Cromer Till.

The origin and correlation of the beds between the Upper and Lower Boulder-clays on Flamborough Head constitute at once the most difficult and most important of the problems presented by the sections. It is here that Mr. Lamplugh differs so materially from previous writers, and since he concludes that the 'Intermediate Series' of Flamborough passes laterally into the Purple Boulder-clay of Holderness, the proofs will be strictly challenged when we bear in mind how little these have in common. The sections north of Bridlington Quay show clearly, he says, that in spite of the apparent difference, the stratified beds are really equivalent to the Purple Boulder-clay, since we can trace the greater portion of the clay until it is shredded out and merged with the bedded loam and gravel. Although this equivalence only holds good in a general way, yet, broadly speaking, the great mass of the Purple Clay may be said to resolve itself, in the Flamborough sections, into stratified deposits. That portion of the 'Intermediate Series' on the crest of the escarpment at Speeton, described by Messrs. Wood and Rome as denudation-gravels of post-Glacial age and supposed by them to have been formed during a great submergence, is really due to the melting on the spot of the Purple Clay ice. This was Mr. Wood's final opinion, essentially the same as that of the late Prof. Carvill Lewis.

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With the ice filling up the bed of the North Sea to the extent indicated by the Basement Clay, and this ice not of local origin (for it is clear that the Yorkshire Wolds added nothing to it, and were not entirely submerged by it), there must have been a time when the great ice-sheet rested with its flank upon this coast-line while the main current swept southwards, following the deepest part of the sea-bottom. At the time of its greatest extension the ice seems to have been 500 or 600 feet thick at Speeton, and a thin flange from the top of the glacier probably passed over the edge of the cliff there during the deposition of the Basement Clay. So long as the edge of the ice was advancing no very great accumulation of material could well take place at its margin, but as soon as its growth was arrested and it began to decline there must have been a considerable deposition in this quarter. It is to the washings of such morainic material at the margin of the ice that Mr. Lamplugh ascribes the origin of the 'Intermediate Series' of Flamborough and of the northern part of Holderness. In the neighbourhood of the Humber there may have been some difference of origin, and possibly the sea was not entirely excluded from the old bay, where in some places it might have laved the edge of the glacier. Whilst the 'Intermediate Series' was being formed at the edge of the ice during a period of slow recession, following a long pause, the formation of Boulder-clay was still being carried on over the area covered by the glacier, and thus, he says, originated the Purple Clay of Holderness. These beds he is inclined to correlate with the Contorted Drift and Middle Glacial gravels of Norfolk.

With regard to the Upper Boulder-clay, he considers that as the ice in the North Sea gradually diminished in volume, so the products of the Teesdale glacier were able to make themselves more and more felt. When the ice, from want of renewal, gradually melted away, there resulted a stony and earthy residuum, and the Upper Boulder-clay is in part the result of this action. The Hessle Clay of Messrs. Wood and Rome, which they describe as a mantle covering everything, had a similar origin in Holderness.

Such is a brief outline of Mr. Lamplugh's views on the Glacial deposits of East Yorkshire. We seem to recognize in this Upper Boulder-clay, charged as it is with débris of Carboniferous origin, something analogous to the Upper Pennine Boulder-clay of Deeley, where the indigenous glaciers were beginning to re-assert themselves. If this is so, the Author can scarcely be correct in regarding the

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Chalky Boulder-clay as even roughly equivalent to the Upper Boulder-clay of Yorkshire, at least in a chronological sense.

We may naturally suppose that the Chalky Boulder-clay of the South-east of England in its march towards the Thames Valley represents the most intense period of the Great Ice Age—a period when the *vis-a-tergo* was at its maximum. Hence there does not seem to be much chronological value in the tripartite division of the Glacial deposits of East Yorkshire, but merely the physical history of a great glacier-movement. We learn, however, the important lesson that the origin of interglacial gravels may be explained on other and perhaps more probable grounds than those of subsidence and interglacial warm periods.

North-western England and Scottish Highlands.—Lastly we have to consider those portions of our island where glaciers originated, and in this case we naturally turn towards the North-west of England and, farther still, the Highlands of Scotland, regions where for the most part the land is mountainous and the precipitation excessive. The glaciology of these districts had perhaps to a great extent been worked out in previous years; at least there have been no more than two communications to the Society in the past seven years, and these relate to such well-known subjects as the perched blocks at Norber and the Parallel Roads of Glen Roy.

The phenomenon of boulders on pedestals is one that lends itself to illustration. The subject was well handled by Prof. Hughes in connexion with boulders, chiefly Silurian, resting on pedestals of Mountain Limestone in the Kendal district and also at Norber Brow in Craven. He assigned their origin, not to icebergs nor to the stony residuum of a washed-out Boulder-clay, but to certain conditions which arose during the recession of the great ice-sheet. There must have been, as he remarks, oscillations during the general recession, and he thought that the glacier in its last advance might have picked up the boulders due to the weathering of massive beds, which had been exposed when it had receded somewhat. Nor was this all, for the ice had been able to carry these boulders up and over the brow of a hill. On Norber Brow, he says, this pushing uphill of the boulders is well marked, for here the blocking of the mouth of the valley by a ridge of grit forced the ice to higher levels. We here perceive the effects of an obstruction in the path of the ice, though on a small scale compared with those gigantic results which have been claimed for the ice of the Irish Sea.

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As regards Scotland, Mr. Jamieson has contributed some Supplementary Remarks on Glen Roy, and this is the only paper on Pleistocene Geology that we have received from the other side of the Border. The history of this controversy is familiar to all, and most geologists are acquainted with the general principles, if not with the details, of Mr. Jamieson's explanation of the origin of the famous Parallel Roads.

Since there had been objections to his hypothesis on the grounds that it seemed strange for one set of valleys to be filled with ice and another set, in close proximity, with water, the Author points out that, as the rainfall on the west side of Scotland is quite double of that on the east side, so also in the Glacial Period must have been the snowfall. He indicates on a map, to which meteorologists are by no means strangers, those portions of the country which, from excessive precipitation, were likely to have been the most strongly glaciated. The wettest part of the country nowadays lies along a line extending from the mouth of the Clyde to the island of Skye, passing right across the western entrance of the Great Glen of Scotland through which runs the Caledonian Canal. The two great ice-fields which must have resulted from the immense snowfall over this district would coalesce hereabouts, and there must have been a great congestion, especially towards the head of Loch Linnhe.

He concludes that the quantity of ice filling the Great Glen and the mouth of Glen Spean was such that it eventually overflowed the passes leading eastwards into the valleys of the Nairn and the Spey, notwithstanding that many of these passes are higher than those on the west which lead out into the Atlantic. Consequently, before the era of the lakes which produced the Parallel Roads of Glen Roy, the western ice actually discharged itself through the very *cols* over which the water from the lakes flowed at a subsequent period. He further points out that during the maximum glaciation it was the cumulative effect of such storage of the surplus snow and ice, continuing through so many ages, which gave rise to similar remarkable results not only in Scotland, but in Ireland, Scandinavia, and North America.

The state of preservation of the Parallel Roads is such that it is quite clear no glaciers can have gone over them since their formation: hence their origin must be referred to a comparatively late stage of the Glacial Period. Mr. Jamieson supposes that the thinner ice towards the north-east was the first to disappear, so that the ground became clear a long time before the ice gave way in the

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western glens. Such a state of things it was which produced the glacial lakes of Lochaber, and he quotes the authority of Hansen, who maintains that it was the great decaying mass of the 'inland-ice,' and no mere local glaciers, which constituted the barriers of the lakes. The thinner ice towards the north-east having melted, the watershed at the head of the Spey became sufficiently open to admit of water passing out, and a lake resting on the surface of the decaying glacier would in the first instance discharge over this *col*. The several stages are thus explained and the corresponding points of escapement indicated. The alluvium of Bohuntine is considered to be the gravel and mud that fell into the lake from the front of the ice when it stood at the mouth of Glen Roy during the formation of the two upper lines. It also serves to show, in opposition to the opinion of Prestwich, that the lake must have existed for a considerable length of time. During the last stage of the lake the ice-dam retreated gradually from the entrance of Glen Roy until it finally stood across the mouth of Glen Spean. The Author then refers to the ultimate subsidence of the lake and to the traces of a débâcle.

Theories in connexion with Glaciation.

In addition to the mass of papers dealing with what is usually known as the Great Ice Age of Pleistocene time, there have been a few papers in which subjects connected with glaciation have been discussed from a more or less theoretical point of view. These may be grouped as follows:—(1) The evidence of glacial conditions in the Palæozoic era; (2) Date and duration of the [Pleistocene] Glacial and post-Glacial Periods; (3) Misconceptions regarding the evidence of former Glacial Periods.

Evidence of Glacial Conditions in the Palæozoic Era.—Dr. Blanford is of opinion that the existence of boulder-beds over areas so extensive and so widely separated as the Karoo Beds of South Africa, the Gondwána of India, and the Coal-measures of Eastern Australia, all of which boulder-beds might probably be of the same age, renders it likely that these were really contemporaneous and due to one great Glacial Period, occurring towards the close of the Palæozoic era. He even goes so far as to speculate on the possibility of this presumed Glacial Period having terminated the Palæozoic era by destroying many of the principal forms of life. How far the floras of these beds justify such a supposition must be decided by those well versed in palæobotany, but at least it is not claimed

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that either fauna or flora presents any modifications due to severe cold. In other words, nothing analogous to an Arctic or sub-Arctic fauna or flora, such as we find in Pleistocene times, is presented to us from these Upper Carboniferous beds. The evidence in favour of glaciation appears to be of a purely physical nature, and rests mainly on the frequent presence of smoothed and striated boulders in the midst of a matrix of fine silt.

Mr. David is equally certain that in New South Wales there are glacial beds of Carboniferous age; and as some of these are marine, the glaciation would seem to have extended to the sea-level, since we are told that nothing but ice-action could have brought these boulders into their present position. There can be no doubt that many persons in New South Wales, as elsewhere, are content to accept these appearances as evidence of glacial action, but that is not quite the same thing as the establishment of a Glacial Period at the time in question. Admitting for argument's sake that ice-action alone could have produced these striations and distributed large stones in the midst of fine silt, it must at least be shown that the glaciation was something more than what may be expected to occur in the vicinity of lofty ranges of mountains which have been recently elevated.

As a supplement to Mr. David's paper I would draw attention to a Special Report issued by the Colony of Victoria and compiled by Mr. Dunn, with reference to the celebrated 'Glacial Conglomerate' at Wild Duck Creek.[1] The chief feature of this remarkable publication is the number of striking photographs showing striated boulders, and most remarkable of all are the photographs of the striated bed-rock, which is stated to be of Silurian age. Dr. Wallace brought this publication to the notice of English geologists a few weeks ago.[2] He considered that the whole of the phenomena of Wild Duck Creek point unmistakably to glacial action. Referring subsequently to a list of localities in Eastern Australia where similar conglomerates have been found, though the indications of glacial action are not specially mentioned, Dr. Wallace remarks that "if these deposits are really all glacial and contemporaneous, they indicate an extent of glaciated country that would imply either a very lofty mountain range or the occurrence of a real glacial epoch in the southern hemisphere."

[1] 'Notes on the Glacial Conglomerate, Wild Duck Creek.' By E. J. Dunn, F.G.S. Melbourne, 1892.

[2] 'Nature,' Nov. 17th, 1892, vol. xlvii. pp. 55, 56.

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From the original discoveries of the Blanfords in India, and from the further evidence of the Dwyka Conglomerate in Africa, there can hardly be any doubt that similar deposits, approximately contemporaneous, extend over a very wide area. Indeed, one cannot help calling to mind that even in Britain the Permian conglomerates and breccias have often been and still are quoted as evidences of a Palæozoic ice-age. That something very remarkable occurred in the physical history of the earth's crust about this period (Permo-Carboniferous interval) is perfectly certain, and the results of this action may be traced over widely separated regions. It is quite legitimate to seek for an explanation of the cause, but geologists especially should be careful how they accept theories which require the earth's axis of rotation to be shifted, or which profess to account for general climatic conditions, which perhaps never existed, during the period in question.

Date and Duration of the Glacial (and 'post-Glacial') Period.—Two well-known authors have ventured to place an approximate chronological value on the whole or on a portion of Pleistocene time, viz. Prof. Prestwich and Mr. Mellard Reade.

Prof. Prestwich commenced by stating his belief that there is no valid evidence of the recurrence of Glacial epochs; and he pointed out the divergence in the late Dr. Croll's estimates as to the beginning of what is usually known as the Glacial Epoch, these estimates having ranged from nearly a million years ago to something less than a quarter of a million years ago. Prof. Prestwich is inclined to believe that a much smaller figure than the lowest of these will suffice, basing his calculations, in part, on a study of the laws affecting the growth of ice and the motion of glaciers. The observations made by Steenstrup, Rink, and others in Greenland tend to show that there is a general movement of the 'inland ice' towards the sea, and that it concentrates its force upon comparatively few points, which are represented by the so-called ice-fields, through which the annual surplus of ice is carried off. The velocity of the ice was noted in seventeen glaciers, and it was calculated that these move at rates varying from 30 to 50 feet *per diem* throughout the year, the rate of movement not being materially influenced by the seasons. The precipitation in Greenland is thought to be less than 20 inches per annum. From the above data, and bearing in mind the ratio of ice-front to rock-front along the whole coast, the total annual discharge is equal to a fringe of ice one-eighth of a mile in breadth, or one mile of ice in eight years.

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Taking as the known quantity the results supplied by the observations in Greenland, the equation, he says, will be as follows:—A surplus-ice overflow equal to one mile advance in eight or twelve years, *minus* (1) the retardation due to friction and irregularities of the surface, and (2) to seasonal changes of temperature (the so-called interglacial periods): *plus* (1) the increase of discharge due to progressive secular refrigeration and (2) further to increased precipitation. The known quantity, he says, gives us from 4000 to 6000 years. He allows that of the unknown quantities we can at present form but a distant idea, although he thinks it will be found that the time required for the formation and spread of the great ice-sheets in Europe and America need not be extended beyond 25,000 years at the utmost, including in this estimate the time during which the cold was increasing, or pre-glacial time, and that during which the cold was diminishing, or post-glacial time. The close of the Glacial Period, *i. e.* the final melting of the ice-sheet, might have taken place from 8000 to 10,000 years ago.

We must all admit the interest which attaches to calculations based on the rate of motion in the Greenland ice-sheet, yet the unknown elements, and especially the uncertainty as to the duration of the period of refrigeration, seem to cast a shadow upon this attempt to estimate the duration of the Glacial Period. However, the Author himself explains that he does not attempt to fix actual terms of years, but only wishes to show that we must not unhesitatingly accept such large measures of time as have in some instances been required.

It is curious to note how different a view Mr. Mellard Reade takes of the duration of what is usually termed post-glacial time. While Prof. Prestwich thinks that the final melting of the Great Ice Sheet is not likely to have occurred more than 10,000 years ago, Mr. Reade claims for events succeeding the deposition of the low-level Boulder-clay of Lancashire a period of 57,500 years, which is made up as follows:—He assigns a period of 40,000 years to the elevation and erosion of the Boulder-clay, one of 15,000 years for the deposition of the post-glacial beds, such as estuarine silt and *Scrobicularia*-clay succeeded by peat and forest-beds, and a further 2500 years for the blown sand which covers these in many places.

It seems tolerably certain that, when an author is bold enough to attempt a chronological scheme of this nature, the arguments of most of the speakers aim at demonstrating the impossibility of reducing

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geological time to years. Such was conspicuously the case when Mr. Reade's paper was brought before the Society. Undoubtedly, when the slopes were steeper, the rate of denudation and consequently of deposition would be more rapid, and this fact is held by some to invalidate any calculations based on the present rate of deposition of silt.

Misconceptions regarding the Evidence of former Glacial Periods.—Lastly, we possess in the paper which bears the above title a legacy which the late Dr. Croll may be almost said to have bequeathed to the Geological Society. His cardinal point was that the evidences of glaciation are to be found principally on land-surfaces, and that the transformation of a land-surface into a sea-bottom would probably obliterate every trace of glaciation.

He even went so far as to assert that the absence of large erratic blocks in the stratified beds may indicate, in some cases, a period of extreme glaciation. The more complete the glaciation, says Dr. Croll, the less probability of the ice-sheet containing any blocks, since the rocks would be covered up. This assertion was especially aimed at Nordenskjöld's statement that there is no evidence of glacial conditions in the strata of Greenland and Spitzbergen down to the termination of the Miocene period, the absence of large boulders being conspicuous in beds of that or earlier date. It suited Dr. Croll wholly to ignore the character of the faunas and floras which have been discovered in these high latitudes. Moreover, he seems to have been unaware that, by adopting this line of argument, he was claiming for pre-Miocene times a greater amount of glaciation than that which prevails in Greenland and Spitzbergen at the present day. Neither of these countries now presents the phase which marks the complete glaciation imagined by Dr. Croll, since there is abundance of morainic matter and rock-detritus at the margins of the inland ice.

The real state of the case seems to have been that Dr. Croll, as an astronomer and mathematician, was perpetually calling upon geologists to find evidence of the truth of his favourite hypothesis, viz. the recurrence of glacial epochs. These latter for the most part have been wholly unable to respond to the call, and, except in the doubtful cases previously mentioned, it can hardly be said that there is any positive evidence in support of Dr. Croll's cardinal point, although we cannot help admiring the dexterity with which he contrived to fire a Parthian shot into the camp of the enemy.

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Tertiary Geology.

Having spent so much time over papers relating to Pleistocene Geology, it will be necessary to touch but briefly on matters which otherwise might well have occupied our attention at greater length. The Tertiary Geology of West Surrey and East Berks, taken *per se*, is mainly of local interest, but any attempt based on palæontological data to correlate portions of the London and Hampshire Basins, and so pave the way, if possible, for a more uniform nomenclature, must be regarded from a wider standpoint.

Upper Eocene.—Such a paper was presented to the Society by Messrs. Gardner, Keeping, and Monckton, entitled 'On the Upper Eocene, comprising the Barton and Upper Bagshot Formations.' The primary object which the Authors had in view was to effect a partial revision of the grouping of the older British Tertiaries, in consequence of the introduction of the Oligocene into our classification. Unless, as they observe, the considerable literature relating to the Bracklesham, the Calcaire Grossier, and the Nummulitic is to be rendered obsolete, their classification as Middle Eocene must be preserved, and a modified Upper Eocene constructed out of the Barton Series. Secondly, then, the Barton Series, as developed in Hampshire, is to a certain extent remodelled, with an adequate notice of its very abundant fauna: and thirdly, it is shown by way of correlation that, in all probability, the beds hitherto known as the Upper Bagshot Sands in the London area correspond to the lower portion of this series, *i. e.* to the Lower Bartons.

It is admitted that the base of the Barton Series is not sharply defined, since there is no boundary-line of importance, palæontological or lithological. Indeed, if the section at Whitecliff Bay, which the Authors regard as the most perfect in all the Eocene formation in England, had been the original or type-section, a different arrangement, we are told, from that which now exists might have been entertained. Here the fauna of the Lower Brackleshams, with its giant Nummulites, Bullas, and Cowries, and its wealth of Corals, differs far more from that of the Upper Brackleshams than the latter does from that of the Bartons. Had the Barton Series been in the first instance described from the Highcliff section in Christchurch Bay, and then followed from west to east, taking first Alum Bay and then Whitecliff Bay, the entire Upper Bracklesham Series would have found a place in it, and the base-line would have been drawn where a decided physical change is manifest. However, the division as now made coincides with the final disappearance of several

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subtropical Mollusca, and almost with the extinction of Nummulites in our area. There is less difficulty about the upper limit of the Barton Series, which is drawn at the base of the Lower Headon, where the brackish-water fauna gives place to one of freshwater origin.

A considerable portion of the paper is then devoted to a detailed description of the Barton Series as developed in Christchurch Bay, an ascending section being given, and the measurements compared with those of previous observers, such as Prestwich, Bristow, and Wright. The zone of *Nummulites elegans* is taken to be somewhere about the base of the Lower Barton Beds. I may mention, by the way, that a paper was read before the Society by Prof. Rupert Jones in 1886, where it was shown that Sowerby's labelled specimens of '*Nummularia*' *elegans* are really the same as the var. *Prestwichiana* of *Nummulites planulatus*. We may believe, then, that the *Nummulina Prestwichiana*, auct., is really the same thing as *Nummulites elegans*, Sow. Since this line is to be taken as the base of the Upper Eocene, it is at least important that the synonymy of the name-giving Nummulite should be settled.

The Lower Barton or Highcliff Beds are estimated at about 50 feet, consisting mainly in their lower parts of stiff drab-coloured clay, which higher up becomes filled with sand drifts full of fossils, the uppermost portion being known as the Highcliff Sands; this part of the series terminates with the *Pholadomya*-bed. Its fauna comprises many Bracklesham species, which range no higher up, and it also contains a large number of peculiar species. The base-line fixed for the Middle Barton, or Barton Clay proper, is the lowest of several bands of septaria, which distinguish the 50 feet of drab-coloured clays comprised in it, and this last division terminates in a very remarkable formation, known as the Shell-bed, which, although only a foot or two thick at Highcliff, increases towards the east. The fauna of the middle division of the Bartons is nearly as rich as that of the lower, and far more characteristic. Some of the grandest species, such as *Rostellaria ampla*, *Fusus longævus*, and *Murex minax*, range from the Bracklesham right through the Barton, but attain their finest development here. Others, such as *Cassidaria nodosa*, *Ficula nexilis*, *Triton argutum*, and *Fusus regularis*, pass upwards from the Bracklesham, but do not range beyond the limit of this division. The finest specimens of the strictly Barton fossils, *Voluta luctatrix*, *Crassatella sulcata*, and *Limopsis scalaris*, are obtained here, while others, such as *Voluta ambigua* and *Pleurotoma*

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rostrata, cannot be collected at all above this zone. Finally, several small but well-known species, such as *Conus dormitor* and *Buccinum desertum*, here make their first appearance.

The Upper Barton division is represented as having a development of 90 feet, and is far more variable both in its fauna and lithology; in fact it comprises within itself a triplicate subdivision, of which the upper portion contains the Hampshire Upper Bagshots, which are also known as the Headon Hill Sands (the Long-Mead-End Sands of the Authors). This Upper Barton as thus constituted is, in fact, a somewhat artificial division, its base being the *Chama*-bed. The fauna of the *Chama*-bed numbers altogether 170 known species, and differs, as a whole, more from that of the Lower and even Middle Barton than does that of the Lower Barton from the Upper Bracklesham. The greater number of what may be considered the typical Barton species have disappeared. It is difficult to say positively whether the change was from deeper to shallower water, or the reverse; but the shell-bed preceding the *Chama*-bed plainly indicates a long period when no mud was being deposited, and the *Chama*-bed itself was formed in clear water. It serves to show, like so many other abrupt transitions in the Eocene, that a relatively slight change in physical conditions makes a far greater impression on the succession of life in a formation than would be occasioned by an enormous lapse of time without such a change. This is the last appearance of *Chama* in England.

An analysis of the entire Barton fauna is given towards the end of the paper, with a table enumerating also those species which ascended from below, and those which continued into the Headon Series. A somewhat critical examination of the Edwards collection shows about 527 varieties of Mollusca from the Barton Beds entitled to specific rank, and the Authors are not of opinion that this number will ever be greatly exceeded. Fossils belonging to other groups bring the fauna to a possible total of 600. The list comprises 23 Vertebrates, 47 Invertebrates other than Mollusca, 257 Gasteropods, and 150 Bivalves, exclusive of over 120 undetermined species.

The Barton Series in Hampshire is now separated from its representative in the London Basin by an interval of about 60 miles—a break in all probability due to post-Eocene denudation. There can be no doubt that exact correlation in this case must be attended with much difficulty; still the Authors roundly assert that the fauna precludes the idea of any correspondence between the Upper Bagshot Sands of Surrey and the sandy beds of the Upper Barton,

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heretofore known as the Upper Bagshot Sands of the Hampshire Basin. The Surrey Upper Bagshots they consider to be such as might have been accumulated in a bay of the open sea, while in Hampshire the Barton Series was evidently laid down within the influence of a considerable river.

Accepting as the dividing-line between the Middle and Upper Bagshots of Surrey the bed of pebbles which is stated to occur persistently over the London Basin, the greatest proved thickness of the Upper Bagshots is about 230 feet. The various levels at which the pebble-bed is found are considered to show that the formation rests on a syncline of Bracklesham Beds, and is probably conformable with them. There seems to have been just a suspicion in the minds of the Authors, or of one of them, as to whether the Upper Bagshots of the London Basin are not partly or even mainly of Upper Bracklesham age; but if they are to be regarded as Barton at all, there can be no doubt whatever as to their being Lower Barton. Subsequently the Authors appear to conclude that it would be unreasonable to put the whole of the 230 feet of Upper Bagshot Sand into the Bracklesham Series.

The fossils on which these correlations are based were mainly obtained about the middle of the Fox Hills, on the Woking-Aldershot line, by Messrs. Monckton and Herries. The Authors indeed consider it certain that the Upper Bagshots of the London area were once at least as fossiliferous as their equivalents in Hampshire, and the remarkable condition of some of the Hampshire beds when not protected by clays gives some colour to this supposition. The list contains 52 species of Mollusca, of which 43 could be determined specifically. Thirty-one are common to the Upper Bracklesham and the Barton, and there are nine Barton species unknown in the Bracklesham. Making allowance for the effects of more sandy conditions, the palæontological evidence agrees with the stratigraphy, the presence of the few Bracklesham forms leading the Authors to place the Tunnel-Hill horizon of the Woking-Aldershot line a little below that of Highcliff in Christchurch Bay.

Should exact correlation betwixt beds of the London and Hampshire Basins be ultimately possible, it would seem almost unnecessary to perpetuate a double nomenclature. It might, indeed, simplify the problem if we abolished the so-called Middle and Upper Bagshots, and replaced these names by those of the richly fossiliferous Hampshire equivalents. There would still remain the variable and extensive underlying series of clays and sands, for the most part devoid of

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molluscan remains, but locally rich in fossil wood, leaves, and fruits, to perpetuate the name of Bagshot in the list of British formations.

Deep-sea Deposits.—Under the heading of Tertiary Geology it will be convenient to consider this subject, since certain deposits in Barbados, described by Messrs. Jukes-Browne and Harrison, are believed to be of late Tertiary age. In the same connexion also is a paper by Mr. Lechmere Guppy on the Tertiary Microzoic formations of Trinidad. The late Mr. Brady, likewise, made an interesting communication to the Society on the so-called Soapstone of Fiji, which, although post-Tertiary in age and not precisely a deep-sea formation as the term is now understood, clearly belongs to the category of Oceanic deposits. The interest attaching to the proofs that deep-sea deposits have actually been raised above sea-level so as to form recognizable geological formations must be my excuse for venturing to deal, however briefly, with matters which do not relate strictly to our own islands. The venue then for the moment is shifted from the coast of Hampshire to the islands of the Caribbean Sea, and more especially to Barbados, whose geology has been described in considerable detail by Messrs. Jukes-Browne and Harrison. These authors were in correspondence with Dr. John Murray, whose conclusions in the main are stated to coincide with their own, and they were further indebted to Mr. William Hill and Miss Raisin for reports on the minute structure of the rocks submitted to them.

The geology of Barbados turns out to be, on the whole, tolerably simple, and one cannot help feeling surprised at such statements as that of Alexander Agassiz, who assumed the island to be a volcanic cone, entirely surrounded by coral terraces which completely hide the cone.[1] This statement may possibly have had its origin in the conventional idea that an insular coral-formation ought to be on the summit of a volcanic peak. On the other hand, Haeckel[2] asserts that the Island of Barbados consists for the most part of fossil Radiolarian ooze, and he proceeds to speculate on the probability that in certain parts of the tropical Atlantic true Radiolarian ooze, like that of the Pacific and Indian Oceans, will eventually be found in depths between 2000 and 3000 fathoms, perhaps over a considerable area. As a matter of fact, the Island of Barbados is composed of three formations. The fundamental rock is a terrigenous series (Scotland Beds) consisting of grits,

[1] 'Cruise of the *Blake*,' vol. i. p. xix.

[2] 'Challenger' Rep., Zool. vol. xviii. pt. 1, p. cli.

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sandstones, and clays, which have been thrown into a succession of folds and flexures. From comparison with rocks in Trinidad, this series is thought to be of Eocene age, and must have been laid down when there was a large land-area in the vicinity. The Oceanic deposits, which rest unconformably on this series, consist chiefly of fine white earths, much resembling soft chalk in general appearance, together with subordinate beds of pink and yellow clay, and occasional layers of grey pumiceous sand or silt. The raised reefs or coral-rocks which cover six-sevenths of the surface of Barbados constitute the third formation. A section across the island from east to west serves to show the mutual relations of these three formations, and exhibits faulting to the extent of a few hundred feet, while the coral-rock is sometimes seen to rest directly on the fundamental series.

The area and volume of the Oceanic Series does not appear to be large; the most complete succession yields an estimated thickness of a little over 300 feet, which is made up as follows:—Resting unconformably on the fundamental rocks are calcareous earths, gradually becoming more siliceous, and succeeded by a great thickness of pure siliceous Radiolarian earths, which again become more calcareous, and are topped by a moderate thickness of chalky earths and marls. All these are, in the main, organic deposits, but above them come very fine-grained argillaceous deposits, and above this, in one place, some 25 feet of grey volcanic mudstones, with a few Radiolaria, but no calcareous matter. We perceive, then, that the first phase was one of calcareous deposits containing from 60 to 80 per cent. of carbonate of lime, with many *Globigerinæ* and other oceanic Foraminifera. Presently siliceous organisms are found in increasing numbers, and at length we arrive at the central part of the series, which is essentially siliceous, some beds containing 77 per cent. of organic silica, with less than ·5 per cent. of calcareous matter, made up principally of Radiolaria, Diatoms, Sponge-spicules, and occasionally associated with layers of pumiceous sand. Higher up, calcareous organisms again make their appearance, and the sequence of organic rocks closes with a second zone of calcareous material, the quantity of carbonate of lime varying from 44 to 80 per cent. Above the last beds there is a rapid change into fine-grained argillaceous earths.

When we come to compare the Barbados rocks, as above detailed, with modern Oceanic deposits we can hardly fail to recognize, more or less completely, the *Globigerina*-ooze, the Radiolarian ooze, and

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possibly the Red Clay of deep-sea investigation, to say nothing of deposits which partake of the nature of mixtures of the above. It must be accounted as a somewhat singular coincidence that this paper on the Oceanic Deposits of Barbados should have been brought before the Society within a few weeks of the publication of the 'Challenger' Report, which deals *in extenso* with the Deep-sea Deposits collected by the staff of that vessel from 16 to 20 years ago.[1] Fortunately many of the results had been given to the world in previous publications, though it must have been a satisfaction to our Authors to have been able to test their conclusions by the more perfected report. Dr. John Murray, on the other hand, has been able to refer to the similarity between the Barbadian deposits and the modern oceanic oozes. But he still expresses doubts whether the deposits of the abysmal areas have in the past taken any part in the formation of the existing continental masses.[2] Again he says that, with some doubtful exceptions, it has been impossible to recognize in the rocks of the continents any formations identical with the pelagic deposits.[3]

We may, however, take it for granted that in more than one island of the Caribbean Sea pelagic deposits are now to be found as rock-masses of considerable importance, some modified in structure, others but little altered. Such being the case, it remains to consider their age, and the inferences connected with their upheaval from the bed of the sea. If we may trust to the scientific imagination the story runs somewhat as follows:—After the earth-movements which resulted in the plication of the fundamental series of 'continental' origin, the area subsided into depths appropriate for the deposition of *Globigerina*-ooze, and so continued to subside until the relative numbers of the calcareous and siliceous organisms became reversed, when finally such depths were attained that siliceous organisms alone remained in the ooze, which now became exclusively Radiolarian. The comparative thickness of the Radiolarian portion of the earths is held to indicate a long period of extreme depth; but presently a reverse action commenced, and the organic series ended, as it began, with a calcareous deposit. When the area again began to subside, and the calcareous matter to diminish in amount, a fine argillaceous substance, believed to be analogous to the Red Clay of the deep sea, was deposited in lieu of the Radiolarian ooze of the first great depression.

[1] 'Challenger' Reports, Deep-sea Deposits, Murray and Renard, 1891.
[2] *Ibid.* p. xxix. [3] *Ibid.* p. 189.

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Beyond this point there is no very clear evidence of the sequence of events, nor indeed are we to expect that every chapter in this geological record should be complete. But, among the many questions which this interesting speculation raises, there are two which seem to call for special attention: firstly, whether the Authors are right in referring the origin of the Red and Mottled Argillaceous Earths to a deep-sea Red Clay, seeing that this theory requires a second great depression of the area. This latter supposition, unless supported by corroborative evidence, seems to be rather a weak point in the argument, though it certainly fits in fairly well with the present condition of the adjacent Atlantic. Here, as we know, in depths from 2500 to 3000 fathoms, Red Clay with but few traces of organisms, siliceous or calcareous, is the predominating deposit. It is evident, however, from the analyses published in the 'Challenger' Report that the term 'Red Clay' is made to cover a great variety of deposits, so much so indeed that it can scarcely be said to possess any definite meaning whatever; and it is necessary to refer to the Synoptical Table in each case, where very interesting details as to the percentage composition of particular samples of Red Clay are available for the student. The chemical analyses are somewhat perplexing, owing to the methods adopted, but Dr. Murray gives us the average composition of the 'Challenger' samples of Red Clay as follows[1]:

	Per cent.
Calcareous organisms	$6\frac{1}{2}$
Siliceous organisms	$2\frac{1}{2}$
Minerals	$5\frac{1}{2}$
Fine washings	$85\frac{1}{2}$

Messrs. Jukes-Browne and Harrison are sanguine enough to consider that if the 'Challenger' samples of Red Clay containing only small amounts of carbonate of lime and the samples of the Barbados Argillaceous Earths had been analysed by similar methods, a close resemblance in composition would have been found in them, and that the differences would have been such only as might arise from the action of organic acids percolating through the rock.

A more important question is presented by the undoubted fact of so large a development of Radiolarian earths, and the inferences which the Authors are disposed to draw respecting the great depths in which these deposits originated. It is a curious circumstance that no Radiolarian ooze is known to occur on the floor of the Atlantic at the present day. Haeckel, as we have seen, predicated the

[1] *Op. cit.* p. 197.

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existence of considerable areas of Radiolarian ooze in the tropical portions of the North Atlantic, but Dr. Murray is less sanguine on this point.[1] Of course, there are plenty of Radiolaria in the Atlantic, but their remains do not collect in sufficient quantities to form a Radiolarian ooze, which according to Murray's definition should contain not less than 20 per cent. of Radiolaria and siliceous organisms other than Diatoms.[2] Such deposits occur sparingly in parts of the Indian Ocean and in the central and western regions of the Pacific. Dr. Murray goes on to remark that even Radiolaria, like the calcareous Foraminifera, are slowly dissolved by sea-water, after the death of the organisms.

There is a general idea, evidently shared by Jukes-Browne and Harrison, that Radiolarian ooze in existing seas indicates excessive depths. Murray himself states that Radiolarian ooze has a greater average depth than even the Red Clay. But it is evident that causes other than bathymetrical influence in a remarkable manner all kinds of oceanic deposits. Attention to the following 'Challenger' soundings will easily show this to be the case. At station No. 116, between Fernando Noronha and Pernambuco, the surface-temperature being 78° F. and the depth 2275 fathoms, the bottom was found to be what is called *Globigerina*-ooze, containing 65 per cent. of carbonate of lime; while at station No. 259, between Yokohama and the Sandwich Islands, the surface-temperature being 77° F. and the depth 2225 fathoms, the bottom was found to consist of what is called Red Clay with only a trace of carbonate of lime. On comparing these two stations, one in the Atlantic and the other in the Pacific, we perceive that, while the surface-temperatures and depths are almost identical, in the one case carbonate of lime, arising principally from calcareous organisms, amounts to 65 per cent. of the whole, whereas in the other case there is scarcely a trace of it.

Again, with regard to Radiolarian ooze, which we have seen defined as a Red Clay with 20 per cent. and upwards of siliceous organisms other than Diatoms, some curious facts may be gathered from a careful perusal of the Synoptical Table in the 'Challenger' Report. It so happened that at station No. 225, between the Admiralty Islands and Yokohama, in the Western Pacific, the enormous depth of 4475 fathoms was reached, the deepest sounding from which a deposit is known to have been procured, and this was found to contain 80 per cent. of Radiolaria and siliceous organisms. Even in this case one or two *Globigerinæ* were observed.

[1] *Op. cit.* p. 208. [2] *Ibid.* p. 203.

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But the chief discoveries of Radiolarian ooze were made in the Central Pacific, within the tropics, between the Sandwich Islands and Tahiti. Considerable depths exist here also, though Dr. Murray's Synoptical Table reveals some curious, one might almost say anomalous, results with reference to the distribution of *Globigerina*-ooze and Radiolarian ooze in this area. For instance, at station No. 270, which is situated about 2½° north of the Equator, the surface-temperature being 79½° F. and the depth 2925 fathoms, a *Globigerina*-ooze containing 65 per cent. of calcareous Foraminifera and only 5 per cent. of Radiolaria occurs; while at station No. 273, which is about 5° south of the Equator, the surface-temperature being 80½° F. and the depth only 2350 fathoms, the floor of the ocean was found to consist of Radiolarian ooze containing no more than 1 per cent. of calcareous Foraminifera, 30 per cent. of Radiolaria and Diatoms, and a large amount of amorphous matter. This is certainly reversing the ordinary conditions in a remarkable manner, when we find in the same part of the ocean, at points separated by only 7° of latitude, two deposits, of which the one, composed principally of calcareous organisms, lies deeper by nearly 600 fathoms than the Radiolarian ooze of the other station. Furthermore, throughout this great area of Radiolarian ooze, while the general depth may be about 2700 fathoms, the very deepest sounding taken is just the one which is represented as containing 71 per cent. of carbonate of lime.

To take an example from the Indian Ocean, there is the case of the Radiolarian ooze between Zanzibar and the Seychelles, a sample of which was brought up from a depth of 2200 fathoms by Capt. Pullen of the 'Cyclops' many years ago. This was stated by Ehrenberg to be a mass of almost pure *Polycystinæ*, such as no sample of a deep-sea deposit had hitherto shown, and it was particularly noticeable that in the whole of this mass of living forms no calcareous tests were to be seen.[1] Unless, therefore, any doubt attaches to the accuracy of these results, we are entitled to quote this as an instance where calcareous organisms are entirely excluded by siliceous ones at the comparatively moderate depth of 2200 fathoms.

With these recent cases before them it would seem unsafe for geologists to indulge too freely in bathymetrical speculations where they happen to discover fossil Radiolarian ooze raised above the level of the sea, as is the case in Barbados, and also apparently in Trinidad. It is plain that causes other than bathymetrical operate now, and probably did so formerly with still greater force, in the

[1] Quoted by Haeckel, 'Challenger' Rep., Zool. vol. xviii. pt. 1, p. cl.

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accumulation of Radiolarian oozes. Consequently, we are not bound to believe that the Tripoli or Polycystine marls of the Mediterranean coasts and islands, for instance, were upheaved from any very extraordinary depths. As a case in point, I may mention the deposit of Oran, stated by Haeckel to be a pure Radiolarian ooze very similar to that now found in the Central Pacific.[1] Without doubt both the Mediterranean and the Caribbean Sea have been in times past, and still are, regions subject to a considerable amount of vertical oscillation. Indeed, the analogies which these two seas present are very remarkable. Each of them is a deep and irregular depression enclosed within a continental area. The Caribbean Sea, it is true, lies more open to the ocean, which possesses many superficial entrances through the submarine continental slope connecting the two Americas. Barbados is on the very edge of this slope, perched like an outwork on the top of a gigantic wall, the greater part of which is submerged. Thus its position perhaps renders it liable to vertical movements of considerable intensity.

As regards the age of the Barbadian Earths, the evidence from organic remains seems to be somewhat contradictory. According to Haeckel, as quoted by the Authors, about 25 per cent. of the Radiolaria found in the Barbadian Earths are likewise known from the recent ooze. Even supposing that the investigation of the recent Radiolaria is somewhat incomplete, such a percentage almost points to a Miocene age, and this seems to have been the view of Haeckel himself. It is also Mr. Lechmere Guppy's view as to the age of the Radiolarian Beds of Trinidad. On the other hand, the evidence as regards the Foraminifera is somewhat uncertain. The late Mr. H. B. Brady remarked that there was still much to learn respecting the Rhizopod fauna of these deposits, before any very satisfactory conclusion could be drawn as to their geological age or the depth of water at which they were formed. Still, he had little hesitation in concluding that of the 81 species of Foraminifera enumerated about 72 are certainly recent forms, and half the remainder probably so. He further adds that an investigation of the Microzoa of a large series of soft deposits from various islands of the South Pacific has yielded a very similar result, and he agrees with Dr. H. B. Guppy, who has assigned to them a post-Tertiary date.

It may be as well to mention here, by way of parenthesis, that the 'Soapstone' of Fiji, described by Mr. Brady in the Quarterly Journal, rests on a sort of Coral-limestone instead of being covered

[1] *Op. cit.* p. clxvi.

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by Coral-rock, as is the case with the Microzoan formations of Barbados. The Fiji deposit is described as a post-Tertiary volcanic mud, formed at a moderate depth, judging from the character of the Foraminifera, and such as might be expected to occur in the neighbourhood of any of the volcanic islands of the Pacific. This, then, would seem to be a more recent formation than any of the Barbadian Earths, and a similar remark may possibly apply to a large proportion of the soft deposits in the Pacific spoken of by Dr. H. B. Guppy.

Referring once more to the Oceanic Deposits of Barbados, the Authors, after balancing the evidence, are led to conclude that they were most probably formed during the period we call Pliocene; and it is possible that, together with the still later Deep-water Deposits, they cover not only the whole of Pliocene time, but so much of the post-Pliocene as elapsed before the rising island reached the level at which reef-corals could build.

Cretaceous Geology.

The communications on the subject of Cretaceous Geology are most conveniently arranged under the headings Upper Cretaceous and Lower Cretaceous.

Upper Cretaceous.—The bulk of the papers relate to this division, and if we are to proceed from above downwards, the first which demands notice is that by Monsieur Cornet, dealing with the Brown Phosphatic Chalk of Ciply in the zone of *Belemnitella mucronata*. Although this relates to Belgian geology, the comparison is of interest, in consequence of a recent discovery at Taplow by Mr. Strahan of a Phosphatic Chalk on a somewhat lower horizon, viz. the zone of *Belemnitella quadrata*, which is stated to be somewhere about the level of the Margate Chalk.

The bed at Ciply which contains the phosphatic matter is about 70 feet thick, but it is only in the central portion that the main phosphatic mass appears, along with many fossils, in the form of brown granules. In these beds, as a rule, the amount of dry phosphoric acid is about 12 per cent., and where no further concentration from natural causes has taken place it is possible to separate the chalk from the phosphate by mechanical processes. Chemical analysis revealed some interesting facts, amongst others the existence of a considerable quantity of nitrogenized organic matter, causing the emission of a peculiar odour on treatment with acid. The Author speculates on the origin of the phosphate in this formation, which he believes was deposited in a sea

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that nourished a numerous Molluscan fauna, and in which Fishes and great marine Saurians abounded, and he seemed to think that there had been no previous discovery of phosphatic beds analogous to those of Ciply.

However this may be, Mr. Strahan's discovery at Taplow, though not of much economic importance in consequence of the limited extent of the deposit, is strictly analogous from a chemico-geological point of view. Here also we have the brown phosphatic grains in a chalky matrix, and it is interesting to learn that these grains are almost entirely of organic origin, Foraminifera and shell-prisms forming the bulk of them. The tests, as well as the contents, of the Foraminifera seem to have been phosphatized, the phosphate appearing as a translucent film in the former case, and as an opaque mass in the latter. In the case of the prisms of Molluscan shells the whole of the phosphate appears in the opaque form. Fragments of fish-bone also are observed to occur in the granular portion, and such, Dr. Hinde remarked, are also present in the Ciply material, but their osseous nature had not previously been recognized. As bearing on the question of the nitrogenized organic substance suggested by M. Cornet, the brown colour of this rock at Taplow is attributed to a substance very near to, if not identical with, humic acid, but stated to contain between 3 and 4 per cent. of nitrogen. Everything seems to point to the remains of Fishes as having been the principal source of the phosphate, although other organisms may have contributed thereto. In the very extensive replacement of carbonate of lime by phosphate of lime which has taken place, it is possible that organic acids, remains of which are still traceable in these rocks, may have played an important part.

Quitting the horizons of the Higher Chalk we will now proceed to consider the lower beds of the Upper Cretaceous, more especially in the East of England, where these beds have undergone a most important revision, principally at the hands of Messrs. Jukes-Browne and William Hill. It must be premised that these Authors had already laid the foundation for their subsequent work by their joint contribution on the 'Melbourn Rock and the zone of *Belemnitella plena* from Cambridge to the Chiltern Hills.' That paper lies beyond the limits of the present Address, though it may be as well to remind you that the *Belemnitella*-marls were therein regarded as forming the summit of the Lower Chalk, while the Melbourn Rock, which rests upon these marls, is taken to be the base of the Middle Chalk, commencing with the zone of *Rhynchonella Cuvieri*.

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Similarly the Totternhoe Stone, a tough grey chalk, often containing phosphatic nodules, which occurs towards the middle of the Lower Chalk Series, is held to separate the Grey Chalk from the Chalk Marl. Thus these old-established divisions and subdivisions of the Upper Cretaceous are shown to be defined by hard beds, possessed of a peculiar lithology and capable of influencing the features of the country. This no doubt has been a great boon to surveyors, who are naturally not too well disposed towards mere palæontological horizons.

Previous to the work of Messrs. Jukes-Browne and Hill on the lower beds of the Upper Cretaceous in West Suffolk and West Norfolk, no one had attempted to trace the zonal divisions which are found in the neighbourhood of Cambridge, through the tract of country which lies between Newmarket and Hunstanton. In this somewhat difficult region lies the clue to the mystery which has so long enshrouded the true relations between the basal beds of the Upper Cretaceous in the South and the North-east of England. The interest which attaches to such a piece of work must be my excuse for treating this matter with somewhat more attention to local details. The results may be said to be of a twofold character; for not only have the relations of the Red Rock of Hunstanton to the Gault been re-established on a more satisfactory footing, but the remarkable diminution in the volume of the Lower Chalk Series within the area has been demonstrated, though the subdivisions remain mostly the same.

Let us for a moment consider the Red Rock of Hunstanton and its equivalents to the southward. This is an old story. Years ago Mr. Wiltshire remarked, in the Quarterly Journal, that the blue Gault with its characteristic Belemnite had been observed to rest on the Carstone at Flitcham, 10 miles south of Hunstanton; but that, rather nearer the latter place, a red clay occurs immediately under the white Chalk, thus connecting the blue Gault with the Red Chalk. It is scarcely necessary to state that the general fauna of the Hunstanton Red Rock was also shown to be that of the Upper Gault. Such in the main had been Mr. Wiltshire's original views, and the objections arising from lithological differences had long ago been surmounted.

Bearing in mind that the existence of Gault in Norfolk had since then been disputed, the Authors paid particular attention to this point. They found that in the Stoke Ferry and West Dereham district the Gault is about 60 feet thick, while in an adjoining outlier *Ammonites interruptus* occurs plentifully in the form of clay casts

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with the inner whorls phosphatized. Mr. Teall had previously noted the occurrence of Gault at West Dereham. From this point the Gault rapidly diminishes southward. At Roydon, which is about halfway between Stoke Ferry and Hunstanton, a boring yielded very remarkable results. Resting on the Carstone we there have 20 feet of Gault, the lower portion blue and argillaceous, the upper portion grey and marly; towards the centre occur buff sub-calcareous rocks, blotched and stained with red, which in a neighbouring section are shown to contain well-known Gault Ammonites and *Inocerami*. In the grey, marly, upper portion Belemnites are abundant. Dersingham is the point where the lithological change becomes more marked. In our Authors' map the Gault, regarded lithologically, is represented as ceasing at this village, and the beds between the Carstone and the base of the Chalk Marl are reduced to some 7 feet in all, as proved by a boring: these beds are marls, greyish white above, yellowish towards the centre, and more argillaceous below, with a tendency to redness in colour.

The next point is to connect the 3 feet of Red Rock at Hunstanton with the 7 feet of Norfolk Gault, which seems to end off in the manner above stated at Dersingham. First of all, there is the evidence of identity of position between the Carstone below and the equivalents of the so-called 'Sponge-bed' above. There is no question as to the identity of the Carstone; the only doubt which could possibly arise relates to the upward limit, and here the Authors admit that their case largely depends upon the exact correlation of the presumed equivalents of the Hunstanton 'Sponge-bed,' which is for them the base of the Chalk Marl, though so unlike the base of the Chalk Marl in other districts. On the whole, the argument from stratigraphical position seems to point to a lithological passage between the Gault and the Red Chalk. It may indeed seem strange to those, who have never recognized the marly character of much of the Upper Gault, that this mainly argillaceous formation should shrink to 3 feet of Red Chalk on the eastern shores of the Wash, nor is it exactly clear through what causes the iron in the Red Chalk appears in the state of sesquioxide, while the iron in the Gault is mainly in the state of protoxide.

The fossils hitherto found in the Norfolk Gault are not very numerous, but nearly all are of species which occur in the Red Rock of Hunstanton, and this fact, coupled with the stratigraphical evidence, seems conclusive as to their being mainly on the same geological horizon. Undoubtedly the Cephalopoda are the best guides in correlating strata of Mesozoic age, and the Authors claim that eight

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species of Ammonites characteristic of the Gault have been recorded from the Hunstanton Red Rock, while those of the higher horizon are not known to have occurred in it. As regards bivalves, there certainly is in the Upper Gault a mixture of Cenomanian forms, and these seem to become proportionally more numerous as the Norfolk area is reached—a circumstance which the Authors attribute to the effect of deeper water.

While dealing with the subject of the fauna of the Hunstanton Red Rock, I should here take the opportunity of mentioning that Mr. Vine has recently contributed a paper on the Polyzoa of that formation. This Author dealt with over a thousand fossil specimens, principally Cephalopoda, Monomyaria, and *Terebratulæ*, on most of which encrusting forms of Polyzoa were found. As a result he recognized 43 species, mostly forms described by foreign authors, but some new. A few of these species have been noted from the Cambridge Greensand. The Polyzoan fauna of the Gault and Chalk Marl, he says, still awaits special attention.

The extraordinary diminution in the thickness of the Gault and its equivalents in North-west Norfolk applies in a less degree to all the subdivisions of the Lower Chalk, which also are said to become more calcareous on being followed northwards. The Totternhoe Stone is traced through Norfolk, being about 2 feet thick at Hunstanton, and its existence enables the limits of the Chalk Marl to be defined. Including the Sponge-bed and the *Inoceramus*-beds of Hunstanton, this thickness is somewhat under 20 feet. The Grey Chalk also thins towards the Wash, being about 30 feet thick at Hunstanton.

Mr. William Hill, in a subsequent paper, carried these investigations on the Lower Beds of the Upper Cretaceous Series into Lincolnshire and Yorkshire, where the character of the strata partakes somewhat of the North-west Norfolk type, though their thickness is usually somewhat greater, except at one place on the western escarpment of the Yorkshire Wolds. His discovery of Gault Ammonites tends to strengthen the view that the equivalents of the Hunstanton Red Rock in the two more northern counties are really on that horizon. Near its most north-westerly exposure on the Yorkshire Wolds the peculiar colour of the Red Rock is lost, but such characteristic fossils as *Inoceramus sulcatus* and *Belemnites minimus* were found associated with a conglomeratic bed of slight thickness.

The base of the Chalk Marl throughout Lincolnshire continues to be marked by a bed of compact limestone, which the Author regards

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as the representative of the 'Sponge-bed' of Hunstanton. This can also be traced in Yorkshire as far as the north-western extremity of the Wolds. Above this bed a few feet of grey gritty chalk retain the character of the Hunstanton '*Inoceramus*-bed' throughout the area above mentioned. In the same district also a well-known rock called the 'Grey Bed' is shown to be on the horizon of the Totternhoe Stone, and thus to determine the upper limit of the Chalk Marl; this bed is characterized by much comminuted shelly matter and by numerous Pectens amongst other fossils. The Author notes, moreover, the red coloration of portions of the Grey Chalk in Lincolnshire, the principal horizons for this coloration being just above the Grey Bed and a little below the Lincolnshire equivalent of the Melbourn Rock.

When the basement-beds of the Upper Cretaceous are traced from their most attenuated outcrop, 600 feet above sea-level, at the north-western extremity of the Wolds, towards the sea, there is every reason to believe that they rapidly thicken again, and when the coast at Speeton is attained the whole series is found to be expanded to a thickness nearly four times greater than at Leavening on the Wolds, and more than twice as great as at Hunstanton. The thickening is shared by all the series below the zone of *Rhynchonella Cuvieri* (at the base of the Middle Chalk), where flints, as a rule, first make their appearance. This classical section is described with much care by Mr. Hill, and many new points of interest are brought out, though time will not allow me to do justice to them. I will only quote one passage for the benefit of those who place their faith in flints as a means of determining horizons in the Chalk. He says:—"The gradual approach of the Chalk-with-flints to the Lower Chalk should be noted, and the value of flints for stratigraphical purposes may be estimated from the following facts:—at Dover they are 120 feet above the zone of *Belemnitella plena*; at Hitchin the first line of flints, followed by others at distant intervals, occurs about 45 feet above the base of the Middle Chalk. In Lincolnshire flints occur in regular lines .... only 15 feet above the Belemnite-marls, and this is reduced by nearly one half at Speeton, where flints come on 8 feet above the Marls." Moreover, at Speeton, beds of flints, some yards in extent, occur in the higher portion of the Chalk Marl itself.

Mr. Hill, as is well known, has paid much attention to the minute structure of the various chalks. With reference to the composition of the Red Chalk or Hunstanton Limestone in Lincolnshire and along the western escarpment of the Yorkshire Wolds, he observes

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that disunited or primordial cells of Foraminifera form a very large part of the mass, shell-fragments are few, and the finer amorphous material appears to be made up entirely of calcareous particles. In Lincolnshire mineral-fragments, probably derived from the underlying Neocomian sands, are found in the lower part of the Red Chalk, while in Yorkshire these fragments are much coarser; in fact, the rock is almost conglomeratic in places, sometimes even when resting on Jurassic clays. This character becomes most marked towards the elevated outcrop near the north-western corner of the Wolds, where coarse shell-fragments, large Foraminifera, detached Sponge-spicules, and glauconitic grains of large size are observed to be abundant. With the thickening of the beds towards Speeton a change comes over the character of the deposit; shelly fragments of small size are abundant and Foraminiferal tests common, but there is a large quantity of fine inorganic material, and it is only in the upper portion that the deposit becomes more purely calcareous.

It may be as well to state here that the topmost beds of the Speeton Clay, on which the Red Chalk reposes, have been shown by Mr. Lamplugh to contain a fauna very closely allied to that of the Red Chalk. He considers that these beds are too thick to be explained as the result of the working up of the underlying clays into the base of the Red Chalk, as supposed by Mr. Hill. It is not a little curious to note how the Gault once more, if only for a few feet, assumes an argillaceous aspect. Mr. Lamplugh suggests that in these beds we have probably a representative of the Lower Gault, while the Red Chalk itself may represent the upper division of the formation—an idea which, no doubt, he shares with other geologists. How far he is correct in correlating this horizon, designated by him as the *Belemnites minimus*-marls, with the Lincolnshire Carstone,[1] is a point which I should not venture to discuss on the present occasion. Clearly, however, he is of opinion that at Speeton the Upper Cretaceous succeeds the Lower without any break of importance.

Before attempting to deal with Lower Cretaceous Geology, we may pause for a moment to consider what may have been the physical history of part of the area covered by the Red Chalk. Starting from Hunstanton, we have seen that the minimum of deposition occurs at two points, viz. at Hunstanton itself and at the north-western corner of the Yorkshire Wolds, the subdivisions of the Lower Chalk being proportionally affected. One of the questions

[1] Rep. Brit. Assoc. (Leeds Meeting), 1890, p. 808.

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which present themselves for solution is to ascertain the meaning of this attenuation, and also the meaning of the attenuation of the Red Chalk, as a whole, by comparison with the synchronous Gault. Messrs. Jukes-Browne and Hill are rather disposed to explain these facts on the assumption of deeper water. Undoubtedly there is less terrigenous sediment, which would at first sight seem to imply greater distance from land. This, however, will not altogether explain the great diminution in the *actual* amount of calcareous matter; for we should bear in mind that there is many more times the amount of carbonate of lime in such a formation as the Upper Gault of Folkestone than exists in the whole of the Red Chalk of Hunstanton. The phenomena in connexion with the equivalent of the Red Chalk at the north-western corner of the Yorkshire Wolds, where its outcrop reposes on a denuded ridge of Jurassic rocks 600 feet above sea-level, seem to supply a clue. Even according to the views of Messrs. Jukes-Browne and Hill there was an approximation to the western margin of the Cretaceous sea at that spot. With this approximation to land we have a minimum of deposit, yet we are asked to believe that the scanty deposit at Hunstanton was due to distance from land and deepening water.

I would venture to suggest that the Red Chalk, as a whole, is not a deep-water deposit, but that it was formed where powerful currents limited the amount of sediment thrown down. The number of small siliceous stones found in it serves to bear out this view. There can be no doubt that such was the case throughout the major part of what is now the Wold outcrop; less so, perhaps, in Lincolnshire, but likely enough at Hunstanton, where some irregularity in the sea-bottom, of the nature of an old ridge, may have caused currents unfavourable to a bulky deposit. Clearly, this must have been the case at the north-western corner of the Wolds. At Speeton, on the other hand, materials swept from the shallower and more troubled portions of the sea, possibly in part from the old Jurassic ridge before it was completely covered up, were deposited in calmer and perhaps rather deeper water.

Lower Cretaceous.—The relations of the Lincolnshire Carstone were described by Mr. Strahan in a paper where he showed that this formation rests on different members of the Tealby group, presenting a strong contrast to them in lithological character, and in being, except for the derived fauna, entirely unfossiliferous. He seemed disposed to associate it more or less with the Red Chalk,

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remarking that where the Carstone thins out to nothing in the north the Red Chalk becomes increasingly conglomeratic in character. This is certainly the case in the outcrops on the western escarpment of the Yorkshire Wolds. We have already seen that Mr. Lamplugh places the Carstone on the horizon of the *Belemnites minimus*-marls of the Speeton section. If these views are correct, the Carstone would seem to belong almost as much to the Upper as to the Lower Cretaceous.

The last paper which remains for consideration in connexion with Lower Cretaceous Geology is that by Mr. Lamplugh, already quoted, 'On the Subdivisions of the Speeton Clay.' There are so many issues involved in this paper, which almost opens up a new history for the Lower Cretaceous Series in England, that it is quite impossible, with due regard to other subjects, to do it full justice. The importance of the Speeton Clay as the fullest development of marine beds of this age in England had been thoroughly realized by Prof. Judd, who pointed out that the section at this place furnished the key by means of which might be identified the more or less isolated and fragmentary exposures of beds of Lower Cretaceous age scattered over the whole of Northern Europe.

Many years of careful attention to these clays, as they are from time to time exposed on the sea-shore, has enabled Mr. Lamplugh to effect considerable alterations in the interpretation of the details of the section. Moreover, in his grouping he has selected Belemnites, always abundant at Speeton, rather than Ammonites, as a means for defining his zones. Subsequently, in association with Prof. Pavlow, of Moscow, who inspected this section under Mr. Lamplugh's guidance in the autumn of 1888, the Speeton Clays have been duly correlated with an important series of deposits in the interior of Russia, and the rich palæontology of their Cephalopoda largely worked out.[1] On this point Prof. Pavlow remarks that the Belemnite fauna is less rapidly modified than that of the Ammonites, thus enabling us to establish larger and more generalized subdivisions in the manner already indicated by his colleague. On the other hand, Ammonites are more sensitive indicators of the lapse of geological time.

Mr. Lamplugh considers that there is a more or less continuous sequence from the clays of the Upper Jurassic, through the Lower Cretaceous into the Upper, where at length the argillaceous

[1] 'Les Argiles de Speeton et leurs Équivalents,' par A. Pavlow et G. W. Lamplugh. Bull. Soc. Imp. des Naturalistes, Moscou, 1892, vol. v. pp. 181–276, 455–570.

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sediments give way to those of a calcareous nature. Hence this had been an area of marine deposition throughout a long period of Mesozoic time, although at no great distance to the westward there must have been an axis of upheaval in the interval of time between the Kimeridge Clay and the Red Chalk. In point of fact, he considers that part of the material removed from this area of denudation to the westward may possibly have contributed to the formation of the Speeton Clays themselves. However this may be, he justly regards the series of beds collectively known as the 'Speeton Clay,' though probably not more than 300 feet thick, as by far the most important exposure of marine beds of Lower Cretaceous age in England, and possibly in Europe.

Accepting Mr. Lamplugh as our guide, we may venture to consider the Speeton section somewhat in detail, proceeding from higher to lower horizons. The zone of *Belemnites minimus* and its allies has already been referred to in dealing with the Upper Cretaceous.

The second zone is somewhat obscured towards its upper part, and it is only the lower part of the zone which the Author ventures to describe with any degree of certainty. *Belemnites brunsvicensis*, Stromb. (*semicanaliculatus*?), is the distinguishing Belemnite. Ammonites are said to be rare in this portion of the section, the most characteristic being *Hoplites Deshayesii*. The fauna generally tends to prove that this portion of the section corresponds with the Lower Greensand and Atherfield Clay of the South of England, which may be regarded as of Aptian age. In Lincolnshire the Tealby Limestone is stated to represent this zone, which has also been recognized in Central Russia. It is quite possible that the correlation of this zone at Speeton with beds in the South of England can only be approximate, since it scarcely seems fair to associate *Hoplites Deshayesii* with the whole of a zone, in so large a portion of which that Ammonite has not yet been discovered.

The third zone may be regarded as the backbone of the Speeton section, and it is on the whole perhaps the most interesting and apparently the most fossiliferous, since the more typical Speeton forms, such as *Ammonites speetonensis*, *Am. regalis* (*noricus*), *Crioceras* ? *Duvalii*, *Meyeria ornata*, etc., occur more or less abundantly throughout certain horizons of this zone. Moreover, the measurements are complete, showing a thickness of about 120 feet. Belemnites which may be grouped under the collective title of *Bel. jaculum*, in which Prof. Pavlow recognizes at least 3 species, predominate throughout this series of clays. Among the Ammonites

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we find in the central, and to a certain extent in the upper portions, great numbers of the section *Simbirskites* of the genus *Olcostephanus*, of which *Ol.* (*Simbirskites*) *speetonensis*, Young and Bird, may be regarded as the most characteristic. The lower part of the zone, on the other hand, is occupied by representatives of the genus *Hoplites*, better known to English readers under the collective title of *Am. regalis* (*noricus*). In this portion of the Speeton section, therefore, *Am. speetonensis* characterizes the upper sub-zone and *Am. regalis* the lower sub-zone, the Tealby Clay being correlated with the former and a portion of the ferruginous rocks of Claxby with the latter. In the clays of this zone at Speeton it is noticeable that many species appear and disappear; but still it is principally throughout this horizon that a Neocomian fauna is encountered. This zone of *Bel. jaculum* seems to be partially represented at two localities in Central Russia.

The fourth zone is one about whose precise age and relations there seems to have been considerable difference of opinion. At Speeton this zone consists of about 35 feet of clays lying between two thin nodular bands, the upper of which is called the 'Compound Nodular Band,' whilst the lower is known as the 'Coprolite-bed.' This is the zone characterized by *Belemnites lateralis*, a group which is held to include five species, viz. *B. lateralis*, Phil., *B. subquadratus*, Röm., *B. russiensis*, D'Orb., *B. explanatus*, Phil., and *B. explanatoides*, Pavl. In the 'Compound Nodular Band' there are still considerable traces of the fauna of the third zone, such as *Hoplites regalis* (*noricus*), *Crioceras*, etc., so much so that it must be regarded to some extent as a kind of blend of the two zones, such as is found to be the case with so many bands in which rolled and transported nodules occur. The Ammonites of this fourth zone are frequently of great size and belong to the section *Polyptychites* of the genus *Olcostephanus*, regarding which Prof. Pavlow writes that representatives of this group are most varied and most numerous in Northern Russia (the region of the Petchora), in Eastern Russia (government of Simbirsk), in Yorkshire, and in Northern Germany. Amongst these forms are the Ammonites referred by Mr. Leckenby to the *Coronati*, and regarded by him as Portlandian, about whose actual position in the Speeton section there has existed a certain amount of doubt.

Mr. Lamplugh admits that the fauna accompanying *Bel. lateralis*, both at Speeton and in Lincolnshire, is peculiar. It includes forms very near to those which attain their complete development in the

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Neocomian beds by the side of those which are developed in the underlying Jurassics. It is this fauna, especially as noted in the upper beds of the zone, which characterizes a deposit of intermediate age. He thinks, however, that a detailed study of the entire fauna will show that its affinities incline to the Jurassic rather than to the Cretaceous. Moreover, he observes that perhaps the *lateralis*-zone naturally divides into two parts. The upper portion in all probability is that which contains the large and numerous species of *Polyptychites*, referred by Leckenby to the *Coronati*; in Lincolnshire this is represented by the Claxby Ironstone. On the other hand, some very fragmentary specimens of smaller forms of *Olcostephanus*, belonging to the section *Craspedites*, are held to mark the lower division, which is correlated with the Spilsby Sandstone. This twofold division of the *lateralis*-zone seems to be more obvious in Lincolnshire than at Speeton, supposing the above correlations to be correct, and it may have been partly suggested in order to bring the sequence into harmony with that which appears to obtain in Eastern Europe. When we come to consider the Russian equivalents *en bloc*, the upper division of the *lateralis*-zone is said to correspond with the 'Petchorien,' and the lower division with the 'Étage supérieur de Rouillier,' the latter being a sort of provisional arrangement for beds of the Russian Jura situated immediately above the undoubted Portlandian. In the Alpine region the whole might be held to correspond with the Upper Tithonian, and, as regards period of deposition, with the Purbecks of the South of England [1] and possibly somewhat higher beds.

The remainder of Mr. Lamplugh's paper deals with beds which are undoubtedly Jurassic, and are therefore only indirectly connected with the subject of Lower Cretaceous geology. Considering for a moment the Speeton section as a whole, the bituminous shales of the Upper Kimeridge call for no especial remark, the first point of interest being the 'Coprolite-bed,' which our Author regards as the base of the overlying clays of the *lateralis*-zone. This 'Coprolite-bed,' he says, is undoubtedly a most important horizon in the series, both stratigraphically and palæontologically. There is a marked change in the character of the deposits almost immediately above it, and also in the fauna. Of the few Jurassic forms that pass it, the doubtful *Lingula ovalis* is the only species yet found in the bituminous shales. Here then is a well-recognized break in the great argillaceous series of Speeton, and it is not easy to say how long a

[1] Pavlow, *op. cit.* pp. 213 and 546 (sep. cop. pp. 35, 188).

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period of time may be represented by these four inches of phosphatic nodules. The list of recognizable fossils is a very small one; but there are those phantom forms, so characteristic of nodule-beds, which most probably represent the defaced casts and other hard parts of an elutriated formation. This, then, was an area of submarine erosion, which apparently lasted so long that when deposition again set in the fauna was no longer the same. There seems to have been something of the sort, though less marked, in connexion with the 'Compound Nodular Band,' which separates the *lateralis*-zone from the zone of *Bel. jaculum*. Here, as we have seen, a great mixture of forms occurs; but the presence of *Crioceras*, for the first time in the Speeton section, seems to show that this bed should be regarded as the base of the series of clays which succeed, and which the Author regards as marking the commencement of the Neocomian in this part of Yorkshire.

Jurassic Geology, including Rhætic.

Upper Jurassic.—In Lincolnshire the late Mr. Roberts endeavoured to make a triple division of the Upper Jurassic Clays. He called to mind that Prof. Seeley had previously divided the Fen clays of Cambridgeshire into Kimeridge Clay, Ampthill Clay (regarded as of Corallian age), and Oxford Clay. The task Mr. Roberts imposed upon himself was certainly a very difficult one, seeing that the region in question is largely obscured by Drift, and the only places where sections can be observed are in the various clay-pits or an occasional railway-cutting. His paper is in some sort a supplement to the Sedgwick Prize Essay, which, though written six or seven years ago, has only lately been published.[1] From this essay we gather that, in Cambridgeshire and the parts immediately adjacent, it is not so difficult to trace the results of the Corallian episode even in the clays. In Lincolnshire, on the other hand, muddy sediments appear to have been deposited without a break, and there are neither limestones nor grits to help in defining the horizon.

The several zones recognized by authors in the Oxford Clay of this portion of England need not detain us on the present occasion; it is enough for our purpose that the clays with Ammonites of the *cordatus*-group are regarded as occupying the uppermost zone.

[1] 'The Jurassic Rocks of the Neighbourhood of Cambridge,' Univ. Press, Camb. 1892.

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The chief interest of this paper centres in the clays above the Oxford Clay, and especially in the possibility of tracing a Corallian Clay between it and the Kimeridge.

The clays which extend to the top of what has been mapped as Lower Kimeridge in Lincolnshire may, he says, be conveniently divided into four zones. The lowest of these is a series of black selenitiferous clays, which he regarded as Corallian for the following reasons:—(1) They occur between the Oxford Clay and what he regards as the basement-bed of the Kimeridge; (2) out of 23 species of fossils collected from this zone 22 are recognized as Corallian; (3) the two characteristic oysters of the Oxford and Kimeridge Clays respectively occur together in this series of clays and in the Corallian, but in no other formation.

If we endeavour to test the value of the first conclusion, it would seem that the black clays are nowhere observed immediately overlying the Oxford Clay, but they are found in several places immediately eastward of what is regarded as the uppermost zone; they are easily distinguished by their darker colours, and from the fact of the fossils never being pyritized. These indications certainly seem to separate the black selenitiferous clays from the uppermost Oxford Clay of the district, though there does not seem to be any adequate explanation of the more general oxidation of the sulphur compounds. The next point is to ascertain how far a profusion of *Ostrea deltoidea* is evidence of the basement-beds of the Kimeridge. That such is the case in the Lower Kimeridge of Ringstead Bay there can be no doubt. In Cambridgeshire the Author remarks that, immediately above a layer of phosphatic nodules, which is regarded as constituting the actual base of the Kimeridge Clay in that district, *Ostrea deltoidea* occurs in profusion. It is probable that this is also the case in Yorkshire, but good exposures of the basal Kimeridge are not very common there. On the whole we may fairly allow that Mr. Roberts has justified his first conclusion.

Turning to the evidence of the 22 recognized Corallian species, this speaks strongly in favour of Mr. Roberts's view as to the age of the black clays. The greatest number of Corallian forms occur in pits at North and South Kelsey, and on the whole the fauna inclines rather to older than to newer beds. The characteristic Corallian sea-urchin is not quoted in the list, and this may perhaps be due to distance from actual reefs, since the spines of *Cidaris florigemma* are not unknown from the Ampthill Clay. Mr. Roberts's third

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conclusion involves the proving of a negative, viz. that the two characteristic oysters never appear together either in the Oxford or the Kimeridge Clay. At all events such an occurrence must be extremely rare, and if there are cases quoted they may possibly be capable of some other explanation. We may therefore admit that clays which contain both these forms of oyster are likely to be of Corallian age.

It is not, perhaps, to be expected that the Geological Survey should lay down the lines of a third clay in Lincolnshire, and so separate the Oxford and Kimeridge Clays, where no beds of the usual Corallian type supervene. Nevertheless the map which illustrates Mr. Roberts's paper is a very useful piece of work, and eminently characteristic of that conscientious and painstaking geologist, whose untimely death we all so much deplore.

Turning our attention now from Lincolnshire to Wiltshire, but still dealing with the Upper Jurassic, I must remind you of an interesting account of a well-sinking at Swindon given by Messrs. H. B. Woodward and E. T. Newton. One cannot help being struck with the great development of Oxfordian beds at this spot, completely reversing the conditions which prevail, for instance, in the Weymouth district, and considerably exceeding the limits assigned to the Oxford Clay by Prestwich at the city of Oxford. There are probably not many places in England where the Oxford Clay and Kellaways Rock together attain a thickness of 572 feet.

Callovian Ammonites occur in the lowest beds, which for a moderate thickness exhibit the sandy conditions of the ordinary Kellaways Rock. These are succeeded by 220 feet of clays containing Ammonites of the *ornatus*-group, in company with many other species. The Cephalopod fauna of these beds is evidently rich, when so many species can be quoted from so limited an amount of material. The results, however, are fairly in accord with what we know of Oxfordian beds generally where the lower zones, as in the upper part of the Kelloway Rock of Scarborough, are full of Ammonites of many species. It is somewhat singular, however, that the well-known Corallian *Am. plicatilis*, should occur in these *ornatus*-clays. The Upper Oxfordian is 290 feet thick; this roughly represents the *cordatus*-zone, and it is very poor in species as compared with the lower beds, just as we see is the case in Yorkshire. The Corallian beds in the Swindon sinking were found to be feebly developed, and one wonders what has become of the massive Rag of Wootton Basset only a few miles away. There is not much to be

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learnt as regards the Kimeridge Clay at this point, but it was mentioned during the discussion that in a boring not far off, which had been commenced in Cretaceous beds, the Portland Sands, so well developed at Swindon, were already wanting.

Saline waters were met with in the Corallian Rocks, and again in the Forest Marble, where the amount was found to be upwards of 2000 grains per gallon, chiefly chlorides. Attention was also drawn to the occurrence of saline waters in the Jurassic rocks at other localities in the neighbourhood.

This seems to be the proper place to notice another paper by Mr. Roberts, 'On the Correlation of the Upper Jurassics of the Swiss Jura with those of England.' He commences by referring to the fact that since the days of Oppel's 'Jura-Formation' but little had been done in this direction, though many new discoveries had been made in both countries. As regards the Swiss Jura itself, it so happens that there is a considerable difference in the development of the Upper Jurassics in the northern and southern districts, and it becomes necessary to institute a comparison between these districts before a more extended correlation is possible. It is scarcely necessary to remark that the grouping is variously stated by different authors, and it is evident that many of the terms borrowed from English geology have a different value in Switzerland from that which they bear in this country.

Departing from the plan hitherto adopted, it seems convenient in this particular instance to follow Mr. Roberts in an ascending sequence, and thus to commence at the base. The importance assigned to the Callovian on the Continent is altogether out of proportion to our practice on this side of the Channel, where the Kellaways or Kelloway Rock is mainly regarded as the irregularly developed arenaceous base of the Lower Oxfordian. If regarded as a palæontological zone, it must be held to underlie that of the *ornatus*-Ammonites. Hence, whatever we may think of the Swiss zone of *Ammonites macrocephalus*, which is a kind of compound of Cornbrash and Kelloway Rock, it is evident that the so-called 'Fer sous-oxfordien' of the Northern Jura answers to a large part of our Oxford Clay. On the other hand, the Swiss Oxfordian Beds answer to the lower part of our Corallian, such as the Lower Calcareous Grit and other beds below the regular Coralline Oolite; while the 'Terrains à Chailles siliceux' and the 'Oolithe Corallienne' correspond to the main mass of our Corallian Limestones. The whole of these beds are but feebly developed in the Southern Jura.

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So far the resemblance holds fairly well; but when we come to consider the equivalents of what used to be called the Upper Oolite in this country, viz. the Kimeridge Clay and Portland Beds, there is found to be a very considerable difference of development which renders correlation more difficult. Thus it is not easy to parallel the 'Calcaire à Nérinées' with anything in England. These beds are very rich, containing 192 species, of which 28 only are recognized as British. The series corresponds approximately in position with a group of beds I once ventured to name 'Upper Corallian' or 'Supra-coralline,' and of which the curious little reef in Ringstead Bay is a notable example. This 'Calcaire à Nérinées' is rich in species of corals. Indeed, one of the most striking differences between the fauna of the British Corallian reefs and those of the Jura is the large number of species of corals in the latter. I can hardly think that the difference of climate can have been so great as to account for the whole of this peculiarity, which may in part have been due to deeper and clearer water.

The next thing to consider is how far the Kimeridge Clay proper is represented in the Swiss Jura, and here we must remember that we are for the most part comparing clays with limestones. In this case also the beds are characteristically developed in the Southern as well as in the Northern Jura. We can hardly find fault with Mr. Roberts for grouping the *Ostrea deltoidea* and *Astarte supracorallina*-clays with the Swiss Astartian; at least they occupy approximately the same relative position, and contain a few of the same fossils. It is more difficult to point out the actual time-equivalents of the Pterocerian in our English beds. Mr. Roberts considered the Pterocerian to be perhaps the most important stage in the whole Upper Jurassic Series, since it forms by far the greater portion of the high ground in parts of the Jura (southern district), where it consists of limestones with some marls. It should be noted that *Pteroceras Oceani* occurs at Boulogne on a higher horizon than is usually assigned to the Pterocerian, viz. in the so-called Lower Portlandian, the Bolonian of Blake.

Next come the clays with *Exogyra virgula*, and these we have not much difficulty in correlating with the Virgulian, which, however, is somewhat irregularly developed, even in the northern district of the Swiss Jura, whilst in the southern district it has only been recognized at one or two spots. These beds take us to the top of the Lower Kimeridge, above which, on the present occasion, I do not propose to go, since the investigation of the various interpretations

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that have been put upon the word 'Portlandian' would occupy too much time. Something of the sort we have already seen in connexion with the Speeton Clay.

Inferior Oolite and Upper Lias.—It might have been thought that the geology of the Cotteswolds had been fairly worked out in previous years, yet there have been two or three communications of some importance dealing more especially with the lowest beds of Inferior Oolite in that region. The late Mr. Witchell, when introducing the subject of the Pea-grit, felt it necessary to preface his work by a few words of apology for venturing to write on so well-known a theme. His corrections may perhaps be regarded as only of local interest, yet the experience which comes of twenty-five years of careful observation and collecting is not to be altogether unnoticed. Mr. Witchell's conclusions were that the Pea-grit is well developed in the Cheltenham area, but thins away towards the south, and is no more than from 3 to 5 feet thick in the Stroud district, where the characteristic lithology of this peculiar formation may yet be distinctly recognized. Underlying the Pea-grit in the Stroud district are several beds of white oolitic limestone, having layers of freestone, as he describes it, alternating with shelly detritus. Attention was especially drawn to the contrast which these beds present, both lithologically and palæontologically, with the Pea-grit. Their poverty in organic remains is also very remarkable, the fauna being limited to a few, very small and ill-preserved Gasteropoda, together with fragments of Crinoids, Urchins, etc. Below this are a few feet of brown sandy limestones, very fossiliferous in the lower portion, and resting directly on the so-called 'Cephalopoda-bed.'

Witchell points out how rich and important a fauna comes in with the Pea-grit, and consequently how necessary it is to separate the Lower Limestone from it. To the substantial accuracy of these views I have myself borne witness.[1] In the Nailsworth district the Pea-grit is only 3 feet thick, but abundantly charged with *Nerinæa*, especially at Longford's Mill; it is a curious circumstance, however, that the Lower Limestone, although 25 feet thick hereabouts, hardly contains any *Nerinæa* or, indeed, any recognizable fossils: in character it rather reminds one of some beds of the Lincolnshire Limestone, and seems to be equally poor in Cephalopoda. Hence we cannot readily say whether the Lower Limestone of Witchell should be classed in the *Murchisonæ*-zone or in the *opalinus*-zone, which

[1] Pal. Soc. vol. xli. (issued 1888), 'Inferior Oolite Gasteropoda,' pp. 60 & 67.

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latter is characteristically represented in the shell-bed at the base of the underlying series. Just the same difficulty occurs at Crickley Hill, near Cheltenham, where the equivalents of the Lower Limestone are almost devoid of fossils,[1] while the 33 feet of Pea-grit which succeeds contains perhaps the richest and most varied fauna, including a coral-bed, to be found anywhere in the Inferior Oolite of the Cotteswolds. Reverting to the Stroud and Nailsworth district, the series for some distance above the typical Pea-grit of that region contains here and there aggregations of brown pisolites —*Girvanella pisolitica* of Mr. Wethered—and since the fauna is practically the same as that of the typical bed, the whole may be regarded as one local series. This cannot, however, apply, as intimated by Mr. Wethered, to the Lower Limestone of Witchell.

With reference to the divisions between the *Murchisonæ*- and *opalinus*-zones, Mr. Buckman has lately found at Symondsbury Hill *Ammonites* (*Ludwigia*) *Murchisonæ* and *Am.* (*Lioceras*) *opalinus* in the same bed. This circumstance, he says, renders it difficult to draw a line of demarcation between Lias and Oolite at the top of the *opalinus*-zone. Such a rare and accidental rencontre of two zonal Ammonites would scarcely, if considered alone, substantiate this view, but in many respects it is not easy to effect a separation between these two zones. Since there has been no serious attempt, so far as I am aware, to draw a line of demarcation between Lias and Oolite at the *top* of the *opalinus*-zone, the question of defining the upward limit of that zone is one of minor importance.

But if Mr. Witchell has been able to supply a correction of some importance to the previously accepted reading of the lowest beds of the Inferior Oolite within a limited area, a more important piece of work has been effected by Mr. Buckman. His paper on the 'Cotteswold, Midford, and Yeovil Sands and on the Division between Lias and Oolite' must be regarded from a wider standpoint, as involving more extensive issues. For some time past there has been considerable doubt as to whether the Yeovil Sands and the Cotteswold Sands, although they both underlie the limestones of the Inferior Oolite, are really on the same horizon. This was a difficulty which I felt when engaged in writing the Introduction to the 'Inferior Oolite Gasteropoda,' and I then came to the conclusion that probably they were not on precisely the same horizon.

[1] *Ptygmatis xenos*, Hudl., occurs sparingly in the shell-bed below the Lower Limestone on Crickley Hill, and this position justifies us in regarding it as the oldest species of *Nerinæa* hitherto discovered in Britain.

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But as these constitute an essentially transitional series, poor in fossils other than Cephalopoda, I did not pursue the subject further at that time.

No stratigraphical palæontologist can, I think, doubt that Mr. Buckman has at length succeeded in proving that the different 'Sands' are not on the same horizon. In the above-mentioned paper he described a series of sections of the typical exposures from the Cotteswolds near Frocester to the neighbourhood of Bridport Harbour. Dividing the series into seven horizons, each characterized by their distinctive Ammonites, viz.—*Am. communis*, *variabilis*, STRIATULUS, *dispansus*, the genus *Dumortieria*, *Am. Moorei*, and *opalinus*, and taking the STRIATULUS-beds as a fixed starting-point, he demonstrated how the several beds varied in regard to that horizon. Thus the Cotteswold Sands, containing a portion of the *communis*-zone together with the *variabilis*-beds, are below the fixed datum-line: the Midford Sands, having *Am. striatulus* at their base and being mainly characterized by Ammonites of the *dispansus*-horizon, are above the fixed datum-line; whilst the Yeovil Sands, containing the *Dumortieria* and *Moorei*-horizons, overlie a bed containing Ammonites of the *dispansus*-horizon and are consequently still later deposits. In South Dorset this test is productive of yet more surprising results. For instance, Mr. Buckman alleges that the Blue Clay of Down Cliff, which lies below the Yeovil or Bridport Sands, has yielded Ammonites of the genus *Dumortieria* and notably *D. radians*. This clay therefore would seem to be above the fixed datum-line. Yet, because it is a clay, it has been regarded as Upper Lias, while the undoubtedly older Cotteswold Sands, extending partly into the *communis*-beds, under recent arrangements are to be classed with the Inferior Oolite.

This is a dilemma from which there is no possible escape, except by impugning the value of the evidence. Consequently we are asked to consider what is meant by 'horizons,' or, as some would prefer to call them, 'geological zones.' There are all sorts and conditions of zones, we are told by a very competent authority,[1] and unless one defines them simply as 'palæontological horizons' there is no definition that would apply to all that have been constituted. Now, it has been urged over and over again that the Cephalopoda, especially in the Mesozoic rocks, are the best guides to life-zones because they were less influenced by physical conditions and are therefore more reliable indicators of time than the other Mollusca.

[1] H. B. Woodward, Proc. Geol. Assoc. vol. xii. pp. 295 *et seqq.*

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It seems to have made no difference to an Ammonite whether he was buried in clay, sand, or calcareous débris, and this fact is very strongly brought out by Mr. Buckman's researches on the Ammonites of the border-zones of Lias and Oolite. At the same time, one must admit that the system of zonal classification by means of Ammonites has, in some instances, been carried to excess. It is quite possible, for instance, that in the case of the old Gloucestershire Cephalopoda-bed and its associated sands there may have been a little too much subdivision; at least some of the so-called zones might be viewed as sub-zones. No doubt these names are a terrible tax upon the memory, especially when the evolution of Ammonite-genera proceeds at its present rapid pace. Furthermore, it must be admitted that zones in some cases blend both laterally and vertically, and it is quite possible that the *Ammonites epônymus*, or name-giving species, may occasionally be found straying within the jurisdiction of another chief.

These and similar points are sure to be urged by any one who is desirous of taking an *ex parte* view of any particular case; but, when all demurrers have been duly considered, there remains a considerable balance of evidence in support of the chronological value of Ammonite-zones. In the case before us, unless we dispute Mr. Buckman's facts, certain Ammonite-forms are observed to occupy definite relative positions over a considerable area. It seems quite in accordance with the maxims of stratigraphical palæontology to believe that each of these forms, or rather group of forms, was fairly synchronous over the area, and that, if we wish to know the age of any particular bed in the series, we must rely upon the Ammonites and not upon the lithology.

These considerations introduce a still larger question, viz. as to where the boundary between the Lias and the Oolites should be drawn. In this connexion I will not discuss Mr. Buckman's suggestion to take the reign of the Hildoceratidæ as indicating an intermediate series, which is to include the Upper Lias and the Lower Division of the Inferior Oolite under the name of 'Toarcian.' On purely palæontological grounds something may be said for this arrangement in those districts, such as Dorsetshire, where a Cephalopod facies predominates; but throughout the greater part of England it would not work at all. Of course, this is to a certain extent an old controversy, but we must not forget that the original divisions were made in England, nor is it likely that they will be altered to suit conditions which prevail in districts far removed from the type-area.

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Reverting to a more practical view of the case, it must be admitted that previous to the appearance of the papers by Mr. Witchell and Mr. Buckman our knowledge of these boundary-beds was to a certain extent defective. This did not arise from want of discussion in former days; for the correlation of the Dorsetshire and Gloucestershire beds had been attempted so frequently that the subject became somewhat distasteful, and men shuddered at the very mention of certain Ammonite-zones. Indeed this controversy extended, at one time, to the greater part of the Inferior Oolite. However, the question before us just now is the most suitable boundary between the Lias and the Oolite.

In the International Geological Map of Europe the base of the *opalinus*-zone was adopted as the lower boundary of the Middle Jurassic. To a certain extent this is a conventional, arbitrary limit, though not without many natural advantages even in those districts where the sequence is complete. If this line were rigidly adopted in England, the bulk of the Yeovil and the whole of the Midford and Gloucestershire Sands would fall into the Lias. Hence all three groups of Sands possess one feature in common, viz. that they lie below the *opalinus*-zone, though the Sands in Gloucestershire descend to much lower horizons than either of the other two, or, in other words, they were deposited earlier. It would save trouble, perhaps, if the line adopted by the International Geological Congress were adhered to in the S.W. of England, and in this way no particular violence would be done to the lithology, as the Sands in all three districts would be relegated to the Lias. Such an arrangement would also suit very well on the Yorkshire Coast, since the lower part of the Dogger is certainly within the *opalinus*-zone, while the Sands that carry the Dogger are characterized by Ammonites of the *Dumortieria* and *dispansus*-horizons. This would be placing the Lias-line somewhat higher than it was carried by Tate and Blake.

It must not be supposed for a moment that I am advocating the adoption of this or any other line; my object is merely to show its incidence in one or two localities. In drawing a boundary, especially on a map, there are many aspects of the question to be regarded, and the resultant is partly the outcome of economic, partly of philosophical considerations. Geological surveyors must look at both sides of the question, while less responsible geologists are granted a freer hand. I must confess that, on the principle of taking all I could get, I did include these Sands within the range of my Monograph of the Inferior Oolite Gasteropoda, though merely

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as border or transitional beds. But there can be no doubt that the rich and characteristic fauna of the Inferior Oolite begins with the *Murchisonæ*-zone, to which the *opalinus*-zone is little more than an appendage. If I may venture to express an opinion, it is that the classification of the Gloucestershire Sands, which lie below the so-called Cephalopoda-bed, with the Inferior Oolite is scarcely to be justified without some qualification.

Miscellaneous Subjects.—So much time has been spent on stratigraphical papers that but little remains for those devoted to pure palæontology. I must not, however, fail to remind you of the recognition by Dr. Hinde of a new genus of Siliceous Sponges in the Lower Calcareous Grit of Yorkshire. The exceptional character of these fossils consists in their having the siliceous skeleton composed almost entirely of globular spicules or 'globates.' The nearest living form, he says, is *Placospongia*, in which both the axis and the dermal crust are formed of globates with an interspace built up of numerous pin-like spicules. Assuming the absence of pin-like spicules in the Scarborough fossil, the differences are more than generic. Considerable interest attaches to this discovery, because many persons had noticed the scattered globates in the Lower Calcareous Grit and also in portions of the Coral Rag, and in this condition they were a puzzle both to Sorby and to Blake. It is only right to mention that some years ago I showed a section full of similar granular bodies to Prof. Sollas, who then maintained them to be globates of a siliceous sponge such as *Geodia*. Now that the sponge itself has been described, we know that this recognition was a step in the right direction.

Mr. Carter, of Cambridge, has materially increased our knowledge of the Decapod Crustacea of the Oxford Clay. The fossils described by him occur immediately beneath the St. Ives rock, and therefore presumably, he says, in the uppermost zone. No more than three or four species had been previously recorded from the Oxford Clay of this country. Mr. Carter has been able to add at least fourteen species to that number, seven of which are identified as foreign forms, and seven are new to science.

The Polyzoa of the Inferior Oolite and Lias have received a considerable amount of attention on the part of Mr. Walford. From the first-named formation he described a series collected in the *Parkinsoni*-zone of Shipton Gorge, Dorset, and the number of forms from that one horizon and locality was stated to be equal to the whole of those described by Jules Haime from the Lias to the

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Kimeridge Clay. He directed attention also to a species from the Lias of the Midlands, whose habits suggest a relationship with the Tubuliporidæ, and for which he proposed the name *Tubulipora inconstans*, in reference to its varying modes of growth.

There are two papers by Mr. Wethered devoted to rock structure and referring principally to the Inferior Oolite. His identification of *Girvanella* in the Oolitic rocks had been previously announced in the 'Geological Magazine' for 1889,[1] where it was shown that this organism was not confined to the Silurians, and that, as an agent in the formation of rocks, it is of more importance than had been previously supposed. In that communication he had established a new species, *Girvanella pisolitica*, which in his opinion was instrumental in forming the Pea-grit spherules in the well-known bed towards the base of the Inferior Oolite. He also showed that a much smaller form built up the pisolitic spherules which occur in the Coralline Oolite near Weymouth, and which he now described under the title of *Girvanella minuta*.

In referring to *G. pisolitica* he discussed the views of Brady and Nicholson as to whether the genus is most allied to the 'Challenger' Foraminifer, *Hyperammina vagans*, or to *Syringammina fragilissima*. Traces of the organism occur in the *Clypeus*-grit, but none have been discovered either in the Great Oolite or the Portland Oolite. Considerable variety is noted in connexion with the subject of *Girvanella*. For instance, there occur (1) spherules with a loosely aggregated form of *Girvanella*-tubules as a nucleus, and (2) this form also occurs in loose aggregations on surrounding foreign objects: in such specimens there can be little doubt as to the presence of the organism. Thirdly, he takes the case of a spherule or granule in which the nucleus generally consists simply of calcite, and the concentric arrangement has a granular, crystalline appearance in which occasional outlines of tubuli may be seen. Last of all is the ordinary oolitic granule, with a clear and well-defined concentric arrangement round a nucleus.

There is something very fascinating in the way the Author gradually and unconsciously, as it were, seems to lead us to the conclusion that possibly the oolitic granule itself has been fashioned by an unseen artificer. It is true he did not claim that *all* oolitic granules are derived from this one source, but his remarks regarding the last of his series plainly show the tendency of his thoughts. Viewed through a microscope, he says, spherules of this type would

[1] Dec. iii. vol. vi. p. 196.

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be regarded as of concretionary origin; when photographed, however, what under the microscope are very obscure dark spots appear like the extremities of tubes which have been cut across. These objects are stated to occur throughout the concentric layers at short intervals, and it is impossible, the Author thinks, to resist the idea that the apparent concentric layers may really be layers of tubuli. On perusing these passages, it is difficult to avoid inferring that Mr. Wethered has a strong inclination to believe in the organic origin of the oolitic granule; but it should be remarked that the position of *Girvanella* as a Foraminifer was not insisted upon, and in recent communications he appears disposed to take a more lowly view of this organism.

In his second paper Mr. Wethered states the results of further examinations of the different beds of the Inferior Oolite, whereby his previous views as to the important part which *Girvanella* has taken in the formation of oolitic granules is confirmed. The precise way in which the formation of the granule was effected, he allows, is not quite so clear. Some critics suggested that the *Girvanellæ* which were found coating the nuclei of the concretions might have been derived mechanically from the calcareous mud of the sea-bed. As regards the nature of *Girvanella* itself Mr. Wethered was able to quote a high authority to the effect that the structure was certainly organic: there might be a doubt as to whether it was vegetable or animal, but the fact that the tubes occur in dense compact wefts and never appear to anastomose seems to dispose of the view that they belong to some kind of perforating *Alga*.

Rhætic.— Mr. Brodie gave an account of two sections in the Rhætics of Warwickshire. The chief point of interest related to a possible unconformity; since in one of the localities, in borings and shafts, black Rhætic shales have been found resting upon a denuded surface of New Red Marl. In answer to questions, the Author saw no reasons for believing that the beds were not in place, but the general impression of those who criticized the paper was opposed to the notion of unconformity.

More recently Mr. Wilson has had an opportunity of describing an excellent section on the south side of Bristol, exposed in a fresh cutting at Pylle Hill (Totterdown). He observes that there can scarcely be any doubt as to what is the true base of the Rhætic at this place, though it is possible there may be some difference of opinion regarding its upper limit. The total thickness of the series at this point is only 17 feet, just half what it is at Aust Cliff.

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He divides the Rhætics into two groups, viz. the *Avicula contorta*-shales and the Upper Rhætic Series. The base of the *Avicula*-beds is characterized by black shales with a very thin seam and small pockets of pyritic grit, containing fish-teeth, scales, and fin-spines, coprolites, and pebbles of white quartz; there is no true 'Bone-bed' as at Aust Cliff. The contrast between this fossiliferous horizon with its Rhætic fish-fauna and the so-called 'Tea-green Marls,' containing nothing but indeterminable plant-remains, must be very strong. Indeed, unless there is evidence of a very different character forthcoming elsewhere, one cannot help expressing surprise that anyone should ever have thought of uniting them. The most natural supposition seems to be that the 'Tea-green Marls' are merely the upward continuation of the Red Marls, where the iron-oxides have undergone slight reduction in consequence of the amount of carbonaceous matter which they contain.

His Upper Rhætic Series, consisting of limestone and shales, is terminated upwards by a band of compact, light blue, concretionary limestone with conchoidal fracture and dendritic markings, which he takes to be the equivalent of the 'Cotham Marble.' This series, besides certain characteristic Rhætic fossils, yields abundance of the little freshwater plant, *Naiadita*, associated with numerous Ostracoda. These beds he regards as homotaxial with the shales and nodular limestones, containing *Estheria*, of the Midlands, which directly overlie the *Avicula contorta*-shales in that region.

Triassic and Permian Geology.

These two systems are so intimately connected in this country that, although the one is regarded as Mesozoic and the other as Palæozoic, they must perforce be taken together. There are indeed geologists who seem disposed to look upon certain developments of the Permian as simply the base of the Trias, and, as we shall perceive in the sequel, there have been wide differences of opinion as to whether certain rocks are to be regarded as Permian or Triassic. The total dissimilarity which prevails between the Permians north of Nottingham (east of the Pennine Chain) and those to the south-west of that town adds to the difficulty. The papers read before the Society relate (1) to the South-west of England; (2) to the Midlands; (3) to the Estuary of the Tees.

The South-west of England.—As regards the first district, Mr. Worth submitted evidence of the possibility of the existence of a submarine Triassic outlier off the Lizard, thus carrying the English

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Trias nearly 50 miles farther to the south-west. The same Author also contributed a paper on the igneous constituents of what he regarded as the Triassic breccias and conglomerates of South Devon, which may be considered in this connexion, although the arguments are mainly petrological. His principal conclusions were that the igneous materials are of local origin; that they consist of granites, felsites, and volcanic types, ranging from andesites to basalts; and that the conditions under which the so-called 'felspathic traps' occur *in situ* lead to the inference that they are volcanic phenomena, which probably represent the final phase of the igneous activity of the Dartmoor region. Mr. Worth's contention, as to the evidence of the connexion of any of these rocks with a possible upward prolongation of the mass of Dartmoor, is hardly necessary, seeing that the origin of the materials may well be sought in the more immediate neighbourhood, where there are so many indications of volcanic activity contemporaneous with the basal conglomerate of the Red Rock Series, whether that series is of Triassic, or, as appears more probable, of Permian age.

This subject, as well as the subdivisions of the Red Rocks of South Devon generally, has been the source of a considerable amount of controversy, as must often be the case where there are few or no fossils to guide the geologist. So far as my own impressions extend, there was a time when all the Red Rocks of South Devon were regarded as of Keuper age. How far this view had any connexion with the age of the so-called Dolomitic Conglomerate of the Mendips is not for me to say. But of late years the researches of Mr. H. B. Woodward and Mr. Ussher, to mention no other names, have tended to demonstrate that the divisions of Keuper and Bunter might be recognized in the Devonshire area; and when this was once admitted it seemed difficult to exclude the Permian, since I am not aware that there are any breccias at the base of the Bunter at all like those to the south-west of the Exe. However, in spite of the resemblance of these basal breccias, in many respects, to the Permian rocks of portions of England and of Germany, it seems to have been conceded that it was better to leave the whole in the Bunter, apparently from lack of any positive evidence to the contrary.

No one can doubt that, apart from preconceived ideas, the *prima-facie* evidence in favour of the Permian age of the basal breccias is very strong. Many of these great blocks are evidently derived from the hill talus or 'screes' that once lay on the neighbouring

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slopes of the Palæozoic mountain-region of Damnonia. In most English districts this class of rock is of Permian age, though of course the great angular blocks that have a similar origin may find a resting-place in strata of any age, if we take the whole world into consideration. But there are several reasons why the basal breccias of South Devon are more likely to be Permian than Triassic: among others, the occurrence of contemporaneous volcanic material incidentally shown by Mr. Worth, and insisted on by Sir Archibald Geikie in his last Presidential Address. What I particularly wish to emphasize just now is the fact that Murchison, as pointed out in the same Address, thoroughly endorsed the views of Buckland and Conybeare as to the resemblance of the Heavitree conglomerate to the German Rothliegende. This appears to have been the original view of the older geologists, and one can only express surprise that the opinions of Murchison, as Director-General of the Geological Survey, were not allowed to have more weight in deciding this matter.

Let us now return to the Devon Coast-section, for the purpose of considering Dr. Irving's first paper on the Red Rock Series. He thought that at the base of the Budleigh Salterton pebble-bed there is a physical break of as much significance as that between the Trias and the Permian of the Midlands. From the pebble-bed eastwards the Triassic system is represented by a series of rocks quite comparable with the Bunter and Keuper of the Midlands, and of these rocks he proceeded to give an account. In the marls which *underlie* the Budleigh Salterton pebble-bed he recognized the equivalents of the Permian Marls of Warwickshire and Nottinghamshire. These pass by gradual transition through sandstones, becoming more and more brecciated, into the great brecciated series of Dawlish and Teignmouth, which were regarded as the equivalents of the great Permian breccias of the West of England and elsewhere.

Prof. Hull believes with Dr. Irving that the Red Rocks of Devonshire are representatives of the Permian and Trias which occupy so large a portion of the district bordering Wales and Salop, and which extend into the Midland counties. He thinks also that the breccia forming the base of the series is a representative of the Lower Permian division. But, in the first instance, he differed from Dr. Irving in assigning the red sandstones and marls of Exmouth to the Trias and not to the Permian, as that Author has done. He (Prof. Hull) compared them with the Lower Red and Mottled Sandstones, and regarded the marls as a local divergence

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from the normal type. Dr. Irving, in his Supplementary Note, still adhered to his contention that these sandstones and marls are really of Permian age, although such a view would necessitate the absence of the Lower Bunter of the Midlands in Devonshire. Prof. Hull has substantially acceded to this view, since he stated, in the discussion on Dr. Irving's second Supplementary Note, that he had concluded the Budleigh Salterton Conglomerate was the real base of the Trias, and that the great series of red marls, sandstones, and breccias below the Conglomerate were of Permian age.

The Upper Division of the Bunter Prof. Hull considered to be well shown at Sidmouth, and he regarded a thin calcareous breccia which occurs in the cliffs there as the basement-bed of the Keuper. In his Supplementary Note Dr. Irving accepted the breccias at Sidmouth as the base of the Keuper, and in a second Supplementary Note he states that he has obtained satisfactory data for determining a similar basement-line in the country between the valleys of the Sid and Otter, where the Keuper is repeated by a great fault.

We can scarcely doubt that the discussions raised by Dr. Irving and Prof. Hull have been useful in directing attention to the Red Rocks of South Devon. It seems pretty evident, more especially after Sir A. Geikie's last Presidential Address, that opinion is likely to swing round to the view of the older geologists that the basal breccias are of Permian age, although it might perhaps be difficult to know where to stop in considering the ascending sequence. But Prof. Hull's final adherence to the views of Dr. Irving, in relegating the Red Rocks of Exmouth to the Permian, will tend to simplify matters if the Budleigh Salterton Conglomerate should ultimately be adopted as the base of the Trias in that district. Finally, we are led to conclude that some revision of the geological maps of the Devon area may be required, though possibly the evidence on which to base the alterations is not yet sufficiently established.

Midlands.—A very interesting paper by Mr. Horace T. Brown, on the Permian rocks of the Leicestershire Coal-field, next demands our attention. This is just one of those investigations which are best carried out by persons living in the district, who have constantly-recurring opportunities which are denied to the occasional visitor. By availing himself of the use of the hand-borer and by studying the results of boring operations on a large scale, in addition to the close observation of numerous artificial sections, Mr. Brown has been able to suggest some corrections in

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the geological map of the district, although confirming the surmise of Prof. Hull as to the Permian age of certain beds of a brecciated character.

Intercalated between the Bunter conglomerates and the truncated edges of the Carboniferous strata at various points are thin beds of purple, marly breccias and sandstones, seldom exceeding 30 or 40 feet, but differing in lithological character from the overlying and underlying rocks. The brecciated series rests with striking unconformity upon the Carboniferous; moreover, a fault which throws the Coal-measures to the extent of nearly 1000 feet does not affect the overlying series beyond some 20 or 30 feet. The dying-out of the forces of dislocation in the Permian beds, the Author subsequently remarks, is a valuable chronological index. The disturbances affecting the lower beds can be connected with the Pennine axis, to the southerly extension of which they owe their origin, affording further proof of the pre-Permian age of that axis. On the other hand, the unconformity between the brecciated series and the Bunter is less obvious, but the Author was able to instance sections proving double unconformity. In addition, the lithological characters of the Leicestershire Permians serve to differentiate them both from the Trias and Carboniferous of that district. They consist of red and variegated marls, bands of breccia, and of fine-grained yellowish sandstone. The breccia-fragments are but little waterworn, the most abundant materials consisting of quartzo-felspathic grits with associated grey flinty slates, vein-quartz, volcanic ash, and igneous rocks, all derived from the older Palæozoics, while the Carboniferous rocks supply limestones, grits, and hæmatite.

The bulk of this material he regarded as having been derived from a sub-Triassic ridge of older rocks a few miles to the southward. Evidence was given of the probability of such a ridge in the country between Hartshill and Charnwood. Owing to certain optical characters observed in the breccia, he thought it preferable to take this view rather than to seek the origin of the fragments in the more distant Hartshill.

The Author concluded that the Permian rocks of the Leicestershire Coal-field belong to the same area of deposition as those of Warwickshire and South Staffordshire, all having formed part of the detrital deposits of the Permian lake, which extended northward from Warwickshire and Worcestershire, and the margin of which was the Pennine Chain. In Warwickshire, however, the break between the Coal-measures and the Permian is less than it is in the Leicestershire Coal-field, since in the former case there is an

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almost unbroken stratigraphical succession from the Upper Coal-measures, including the *Spirorbis*-limestone, into the Permian. This difference in the amount of unconformity is best explained, he thinks, by the fact that the Leicestershire Coal-field, where the greatest stratigraphical break takes place, is almost directly in the line of the Pennine-Charnwood axis, where the post-Carboniferous, yet pre-Permian, movements were at a maximum. Although not absolutely prepared to maintain the lacustrine origin of the breccia, the Author considered that it was practically the re-arranged talus and 'screes' from the harder parts—both of the older and newer Palæozoic rocks—which now form the brecciated beds in the Leicestershire Permians, and which he could no longer regard as merely the base of the Trias.

He was quite prepared to admit that the eastward overlap by higher beds of the Trias is not of itself absolute proof of the existence of a stratigraphical break, amounting to an unconformity, between the brecciated series and the Trias. There is nothing improbable in the view that the breccias might belong to the base of the Trias, representing marginal deposits which swept up the sides of the gradually submerged land, just as is the case with the Keuper breccias at Thringstone, on the borders of Charnwood Forest; these are composed of angular fragments derived from the adjacent Forest rocks. But the evidence of denudation prior to the deposition of the Bunter, coupled with the lithological character of the beds and other considerations, appears to have convinced Mr. Brown that the brecciated series described in his paper must be of Permian age. He also notes that when a bed of breccia is traced for a short distance horizontally it is never found to be very persistent, but dovetails into sandy and marly beds, just as do many of the beds of breccia 'in the fine sections at the base of the Trias on the south coast of Devonshire.' We are naturally led to ask the question—If these Leicestershire beds are of Permian age, why not the fine sections 'at the base of the Trias' on the south coast of Devon?

Estuary of the Tees.—Mr. Wilson's paper on the Durham Salt district, recently supplemented by a note from Mr. Tate, draws attention to a curious piece of Permo-Triassic Geology which would have remained unknown, because unseen, but for borings in search of salt. These were limited when Mr. Wilson's paper was read, but Mr. Tate informed us last summer that at least sixty borings had been put down, so that the extent of the basin has been pretty well defined towards the west and north, but is as yet

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undefined on the dip towards the south-east. The depth of the salt-bed ranges from about 1650 feet at Eston in Yorkshire to about 950 feet at Greatham in Durham, the salt averaging about 80 feet in thickness. Subsequently Mr. Tate announced that the bed, where last touched, was thickening on the dip towards the south-east.

The exact geological position of this bed of rock-salt has been the subject of much divergence of opinion. (1) There is the view, held by Sir Andrew Ramsay, that the principal bed of rock-salt belongs to the Keuper, and that the lower beds of rock-salt, marl, limestone, and gypsum belong to the upper portion of the Permian series. (2) There is the view that all the salt-beds and associated strata belong to the Permian, and that the overlying series of red sandstone and marls represents the Bunter. (3) There is the view that all the salt-beds, and the whole of the saliferous marls, sandstones, and limestones, above the continuous strata of the Magnesian Limestone, belong to the Keuper: that is to say, to the same general series as that which contains the rock-salt in the other districts of the British Isles.

Mr. Wilson is disposed to agree with this last view, which was the one taken by the older geologists; and he is of opinion that these beds of rock-salt lie near the *base* of the Upper Keuper, whereas in Cheshire the salt-beds come high up in the Keuper Marls. From a careful examination of the cores he concluded that there is a close resemblance between the beds which graduate down into the saliferous marls of the Durham salt district and the Keuper Waterstones of the Midland counties, both in general structure and mineral characters. As regards the thin and variable series below the main salt-bed, which the presence of anhydrite, marls, and a kind of limestone had induced Sir Andrew Ramsay to look upon as Permian, Mr. Wilson assures us that these show no resemblance to any known beds of the Magnesian Limestone of Durham. Consequently, he sees no difficulty in the fact that beds towards the base of the Keuper should be possessed of a dolomitic character in a region where the rocks rest on a margin of the Magnesian Limestone Series, more especially when gypsum and anhydrite are found to occur in intimate association with the dolomites of that series. This latter argument seems to cut both ways.

Irrespective of debatable matter as to the precise horizon of the rock-salt, the borings in the estuary of the Tees exhibit a considerable variety both in the Permian and Trias within a limited area. The Upper Keuper Red Marls which form the top beds,

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immediately below the Drifts of the country, go out on the rise towards the north. The red sandstones of the Keuper, which are supposed to represent the Waterstones of the Midlands, etc., are about 800 feet thick. The Red Marls, or Saliferous Series, immediately above the main salt-bed, range from 170 feet to about 300 feet in thickness, and there is a curious absence of the salt-rock itself in the very middle of the field. Generally speaking, according to Mr. Tate, the main salt-rock is sandwiched between two beds of anhydrite, while the underlying saliferous marls, with anhydrite, etc., held by Mr. Wilson to form the base of the Keuper in this region, are usually thin, but vary much in this respect.

The underground Permian rocks are still more variable, especially as regards thickness: ranging from 300 feet at Whitehouse, which lies beyond the salt area on the west (Tate), to nearly 900 feet at Seaton Carew, also beyond the salt district on the north-east. At the latter place the upper portion of the series consists of magnesian limestones with blue shales, gypsum, and anhydrite, preceded by a great mass consisting principally of light grey limestones (? magnesian). No mention is made throughout this great thickness of beds of the yellow sands so characteristic of the base of the Permian in other parts of Durham, and especially conspicuous at Cullercoats, in Northumberland.

In concluding this Address, so far as it has gone, a brief retrospect may not be out of place. Owing to the interest which attaches to superficial geology, this portion of the subject may perhaps be regarded as having received more than its fair share of attention. In regard to that most obscure of all subjects, the history of the drifts in the non-glaciated regions, we seem able to record some real progress. Much remains to be done in this direction, and possibly some day an effort may be made effectually to correlate the great upland gravel-sheets of the south-western counties with those farther towards the east. Coming nearer home, it will be impossible, henceforth, to maintain that there had not been a considerable amount of excavation effected in the Thames basin before the Chalky Boulder-clay reached that area.

But it is in the more obviously glaciated regions of England and Wales that the chief interest has been centred, and in this respect there can be no doubt that a young and vigorous race of geologists is inclined to attribute principally to glacier action many of the phenomena which have hitherto been explained in other ways. The picture of the Irish Sea filled with ice, over 2000 feet thick, is one which the older geologists may perhaps never be induced to contemplate.

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In considering Tertiary Geology at home, I have only ventured to select one paper for special notice, while fully admitting the importance of many of the others, and particularly that by Prof. Prestwich on the Correlation of the Eocene strata in England and portions of the Continent. Deep-sea deposits, which have been considered in connexion with Tertiary Geology, are of especial interest to us islanders, and the excellent paper on deposits of this nature in Barbados has provided us with an excuse for renewing our acquaintance with the recent oceanic oozes which attracted so much attention shortly after the return of the 'Challenger.' In Cretaceous Geology considerable progress has been made during the last seven years. The basal beds of the Upper Cretaceous have proved of especial interest, while the geology and palæontology of the Lower Cretaceous in the North-east of England have undergone a considerable revolution. Jurassic Geology has not presented us with changes of similar importance, although our knowledge of the upper beds of that system has been materially increased, while the border-lands of the Lias and Oolite, like border-lands in general, afford a battle-ground between the palæontological and the lithological stratigraphist. The uncertainty as to whether the breccias west of the Exe should be classed under the Permian or the Trias raises another question of considerable interest.

One word of apology is due to the authors whose works have contributed to maintain the high standard of our Quarterly Journal. Very soon after I began to grapple with the recent work of the Geological Society, it became evident that the task of paying equal attention to all within a limited space was impossible. Already this Address has far exceeded the bounds originally contemplated, and yet many excellent papers have received but scant notice. What with the risks of omission, of misinterpretation, and of erroneous criticism, the position of a President, who ventures to review the work of the Society over which he has been called upon to preside, is not altogether unlike that of a man who tries to lift up a beehive. However, I trust that authors will in all cases place the most favourable interpretation upon my remarks, and that my sins, both of omission and commission, may be speedily condoned. If such should be the case, I shall enter upon the remainder, and possibly more difficult part, of this task with fewer misgivings as to the ultimate result.

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February 22nd, 1893.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

Frederic Lewis Bradley, Esq., Bel Air, Alderley Edge, Cheshire; Walter Thomas G. Burr, Esq., Manor House, Tapton, Chesterfield; Francis Baring Du Pre, Esq., M.A., J.P., Oakwood, Chichester; Wilfred Sessions, Esq., B.Sc. Lond., Russell House, Gloucester; and Harold J. Osborne White, Esq., 35 North Bank, Regent's Park, N.W., were elected Fellows of the Society.

The List of Donations to the Library was read.

The following communications were read:—

1. "On the Microscopic Structure of the Wenlock Limestone, with Remarks on the Formation generally." By Edward Wethered, Esq., F.G.S., F.R.M.S.

2. "On the Affinities (1) of *Anthracoptera*, (2) of *Anthracomya*." By Dr. Wheelton Hind, B.S., F.G.S.

3. "Geological Remarks on certain Islands in the New Hebrides." By Lieut. G. C. Frederick, R.N. (Communicated by Sir Archibald Geikie, D.Sc., For.Sec.R.S., V.P.G.S.)

The following specimens were exhibited:—

Microscopic sections and photographs, exhibited by E. Wethered, Esq., F.G.S., F.R.M.S., in illustration of his paper.

Specimens of *Anthracoptera* and *Anthracomya*, exhibited by Dr. Wheelton Hind, B.S., F.G.S., in illustration of his paper.

Rock-specimens from the New Hebrides, exhibited by Sir Archibald Geikie, D.Sc., For.Sec.R.S., V.P.G.S., in illustration of Lieut. Frederick's paper.

March 8th, 1893.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

Professor Waldemar Christofer Brögger, The University, Christiania; and Monsieur A. Michel-Lévy, Director of the Geological Survey of France, Paris, were elected Foreign Members of the Society.

The List of Donations to the Library was read.

Mr. Clement Reid exhibited, on behalf of Messrs. Langstaffe, Banks, and Peckover, a series of incrustations on their 'anti-incrustator,' an apparatus used to extract lime and prevent fouling

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in boilers. Mr. Reid said that at the last meeting he was challenged to produce artificial calcareous tubes with definite walls, the only structure visible in most of the so-called *Girvanella*. The apparatus illustrated the singular effect produced by fibres in causing the deposition of carbonate of lime. If, instead of on flat hemp-fibres, the incrustation were to take place outside *Confervæ* or other algæ, the result would be a knotted mass of cylindrical calcareous tubes, like those found so abundantly in limestones of freshwater as well as of marine origin.

Prof. T. RUPERT JONES remarked that analogies are of very different values. In this case large vermiform concretions occur on the outside of fibres, while in *Girvanella* the minute body itself is composed of vermiform tubules.

The following communications were read:—

1. "On the Occurrence of Boulders and Pebbles from the Glacial Drift in Gravels south of the Thames." By Horace W. Monckton, Esq., F.L.S., F.G.S.

2. "On the Plateau-Gravel south of Reading." By O. A. Shrubsole, Esq., F.G.S.

3. "A Fossiliferous Pleistocene Deposit at Stone, on the Hampshire Coast." By Clement Reid, Esq., F.L.S., F.G.S. (Communicated by permission of the Director-General of the Geological Survey.)

The following specimens were exhibited:—

Specimens and microscopic sections, exhibited by Horace W. Monckton, Esq., F.L.S., F.G.S., in illustration of his paper.

Specimens exhibited by O. A. Shrubsole, Esq., F.G.S., in illustration of his paper.

Specimens from a Pleistocene Deposit at Stone, on the Hampshire Coast, exhibited by Clement Reid, Esq., F.L.S., F.G.S., in illustration of his paper.

Specimens from Norcot-Kiln, Tilehurst, west of Reading, exhibited by J. H. Blake, Esq., F.G.S.

Specimens of inorganic incrustations and Calcareous Algæ to illustrate the structure of *Girvanella*, exhibited by Clement Reid, Esq., F.L.S., F.G.S.

Deposit of Lime from a Kettle, exhibited by W. Topley, Esq., F.R.S., F.G.S.

New sheets of the Geological Survey Map of Sutherland, exhibited by Sir Archibald Geikie, D.Sc., For.Sec.R.S., V.P.G.S.

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March 22nd, 1893.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

Thomas G. Davey, Esq., Harrietville, Victoria, Australia; Morgan Williams Davies, Esq., Assoc. M. Inst. C.E., 17 Adelaide Street, Swansea, and 7 Victoria Street, Westminster, S.W.; and Joseph Pope, Esq., care of W. F. Bennetts, Esq., Roskear Safety Fuze Works, Camborne, were elected Fellows of the Society.

The List of Donations to the Library was read.

The following communications were read:—

1. "On the Jaw of a new Carnivorous Dinosaur from the Oxford Clay of Peterborough." By R. Lydekker, Esq., B.A., F.G.S.

2. "On a Mammalian Incisor from the Wealden of Hastings." By R. Lydekker, Esq., B.A., F.G.S.

3. "On an Intrusion of Muscovite-biotite Gneiss in the South-eastern Highlands of Scotland, and its accompanying Metamorphism." By George Barrow, Esq., F.G.S. (Communicated by permission of the Director-General of the Geological Survey.)

The following specimens were exhibited:—

Specimens exhibited by R. Lydekker, Esq., B.A., F.G.S., in illustration of his papers.

Rock-specimens and microscopic sections exhibited by George Barrow, Esq., F.G.S., in illustration of his paper.

April 12th, 1893.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

Ernest Evans, Esq., 293 Iddesleigh Terrace, Queen's Gate, Burnley, Lancashire, was elected a Fellow of the Society.

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The List of Donations to the Library was read.

With reference to certain specimens on the table exhibited by himself, and collected by Mr. Ferguson in the interior of the Gold Coast Colony, Prof. JUDD said:—These specimens, which are clearly referable to *Arthrophycus*, Hall (*Harlania*, Göpp.), have been found by Mr. Ferguson in the interior of the Gold Coast Colony. While agreeing in all their general characters with specimens of the same forms so abundant in the older Palæozoic of North America and other regions, they present some distinctive features. Great diversity of opinion exists as to whether these curious forms should be referred to seaweeds, or to the burrows or tracks formed by some new marine organism. While the specimens now exhibited present no features which would help to solve this curious problem, they are of very great interest as coming from an altogether unexplored district, and being the only organic structures hitherto found in that district.

In referring to the following specimens—viz.: Specimen of *Cervus Sedgwickii* (?), Falc., Norwich Crag, Bramerton, exhibited by R. W. Hinton, Esq.; Tooth of Mammoth (*Elephas primigenius*), from Witton, near Bacton, Norfolk, and a Tooth of *Elephas antiquus*, both showing glacial striæ, exhibited by James Reeve, Esq.; Boulder of Lower Carboniferous Sandstone from Hartford Bridges, near Norwich, exhibited by G. W. Page, Esq.,—Mr. H. B. WOODWARD drew particular attention to the glaciated tooth of Mammoth that had been obtained many years ago by Mr. John Gunn, from Witton, near Bacton, in Norfolk. He considered that the specimen was older than the Chalky Boulder Clay, and had been glaciated by the agent which brought that material. He exhibited it, through the kindness of Mr. James Reeve, Curator of the Norwich Museum, because it had lately been referred to by Sir Henry Howorth, and because hitherto no definite remains of the Mammoth had been found in East Anglia, either above or below a mass of the Chalky Boulder Clay.

Referring to a portion of a Deer's Antler, identified by Mr. E. T. Newton as *Cervus Sedgwickii* (?), Falc., Mr. Woodward said it had been found in the Norwich Crag at Bramerton by Mr. R. W. Hinton, during a recent excursion of the Geologists' Association, and that the species had not been recorded from strata older than the Cromer Forest Bed.

The following communications were read:—

1. "On some Palæozoic Ostracoda from Westmoreland." By Prof. T. Rupert Jones, F.R.S., F.G.S.

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2. "On some Palæozoic Ostracoda from the District of Girvan, Ayrshire." By Prof. T. Rupert Jones, F.R.S., F.G.S.

3. "On the Dwindling and Disappearance of Limestones." By Frank Rutley, Esq., F.G.S.

4. "On some Bryozoa from the Inferior Oolite of Shipton Gorge, Dorset.—Part II." By Edwin A. Walford, Esq., F.G.S.

The following specimens, in addition to those enumerated on p. 146, were exhibited:—

Lower Silurian Ostracoda from Pusgill, Dufton, Swindale, etc., Westmoreland, collected by Messrs. Nicholson and Marr; also Lower Silurian Ostracoda from Whitehouse Bay, etc., Girvan, Ayrshire, collected by Mrs. Elizabeth Gray, exhibited by Prof. T. Rupert Jones, F.R.S., F.G.S., in illustration of his papers.

Specimens exhibited by Frank Rutley, Esq., F.G.S., in illustration of his paper.

Specimens exhibited by E. A. Walford, Esq., F.G.S., in illustration of his paper.

April 26th, 1893.

W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

Edward John Burrell, Esq., 48 Leyspring Road, Leytonstone, was elected a Fellow of the Society.

The List of Donations to the Library was read.

The following communications were read:—

1. "The Origin of the Crystalline Schists of the Malvern Hills." By Charles Callaway, D.Sc., M.A., F.G.S.

2. "Supplementary Notes on the Metamorphic Rocks around the Shap Granite." By Alfred Harker, Esq., M.A., F.G.S., and J. E. Marr, Esq., M.A., F.R.S., Sec.G.S.

The following specimens were exhibited:—

Rock-specimens and microscopic sections, exhibited by Dr. Chas. Callaway, M.A., F.G.S., in illustration of his paper.

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Rock-specimens and microscopic sections, exhibited by Messrs. Alfred Harker, M.A., F.G.S., and J. E. Marr, M.A., F.R.S., Sec.G.S., in illustration of their paper.

Specimen and microscopic section of Gneiss (Archæan) from the eastern side of the Herefordshire Beacon, Malvern, exhibited by Frank Rutley, Esq., F.G.S.

May 10th, 1893.

W. H. HUDLESTON, Esq., M.A., F.R.S., President, in the Chair.

Henry E. Ede, Esq., A.Sc., Perranporth, Truro, Cornwall; Alfred N. Leeds, Esq., Eyebury, near Peterborough; Fritz Noetling, Ph.D., Palæontologist to the Geological Survey of India, Geological Survey Office, Calcutta; and D. H. Scott, M.A., Ph.D., F.L.S. (Honorary Keeper of the Jodrell Laboratory, Royal Gardens, Kew), Old Palace, Richmond, Surrey, were elected Fellows; and Prof. Marcel Bertrand, Paris, Dr. A. Pavlow, Moscow, and Dr. C. A. White, Washington, U.S.A., Foreign Correspondents of the Society.

The List of Donations to the Library was read.

The SECRETARY announced that copies of sheets Nos. 6, 12, 14, 15 of the Index Map of the Geological Survey of England and Wales (Scale 1 inch=4 miles) had been presented by the Director-General of H.M. Geological Survey.

The following communications were read:—

1. "The Felsites and Conglomerates between Bethesda and Llanllyfni, North Wales." By Prof. J. F. Blake, M.A., F.G.S.

2. "The Llandovery and Associated Rocks of the Neighbourhood of Corwen." By Philip Lake, Esq., M.A., F.G.S., and Theo. T. Groom, Esq., B.Sc., F.G.S.

The following specimens were exhibited:—

Rock-specimens and microscopic sections, exhibited by Prof. J. F. Blake, M.A., F.G.S., in illustration of his paper.

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May 24th, 1893.

W. H. HUDLESTON, Esq., M.A., F.R.S., President, in the Chair.

The Hon. Cecil Duncombe, The Grange, Nawton, Yorkshire John Cary Baker Hendy, Esq., Etherley, *viâ* Darlington; Frederick George Shaw, Esq., Assoc. Inst. C.E., 12 Grafton Street, W.; and John Barret Squire, Esq., Assoc. Inst. C.E., 297 Clapham Road, S.W., were elected Fellows of the Society.

The List of Donations to the Library was read.

The following communications were read:—

1. "Notes on Dartmoor." By Lieut.-General C. A. M°Mahon, F.G.S.

2. "On some Recent Borings through the Lower Cretaceous Strata in East Lincolnshire." By A. J. Jukes-Browne, Esq., B.A., F.G.S.

The following specimens were exhibited:—

Rock-specimens and microscopic sections, exhibited by Lieut.-General C. A. M°Mahon, F.G.S., in illustration of his paper.

June 7th, 1893.

W. H. HUDLESTON, Esq., M.A., F.R.S., President, in the Chair.

Robert M. W. Swan, Esq., F.C.S., 15 Walmer Crescent, Glasgow, was elected a Fellow of the Society.

The names of certain Fellows were read out for the first time, in conformity with the Bye-laws, Section VI. Article 5, in consequence of the non-payment of arrears of contributions.

The List of Donations to the Library was read.

Dr. JOHNSTON-LAVIS, in referring to specimens and microscopic slides showing eozoonal structure in the ejected blocks of Monte

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Somma, exhibited by him, said that all the criticisms of *Eozoon* have so far been destructive, no analogous structure having been found in other localities under conditions that could explain the origin of so curious an arrangement of different minerals. These altered limestones from Monte Somma correspond in all details with those of the original Canadian specimens, and in many cases, on account of their freshness, exhibit some of the pseudo-organic structural details, such as the stolon-tubes, in far greater perfection than does the true so-called *Eozoon canadense*. He had been working at the subject in conjunction with Mr. J. W. Gregory, F.G.S.

The following communications were read:—

1. "The Bajocian of the Sherborne District: its Relations to Subjacent and Superjacent Deposits." By S. S. Buckman, Esq., F.G.S.

2. "On Raised Beaches and Rolled Stones at High Levels in Jersey." By Andrew Dunlop, M.D., F.G.S.

In addition to the specimens exhibited by Dr. Johnston-Lavis (see p. 149), the following specimens were exhibited:—

Specimens, and a series of lithographed figures of Ammonites, exhibited by S. S. Buckman, Esq., F.G.S., in illustration of his paper.

Specimens exhibited by Dr. A. Dunlop, F.G.S., in illustration of his paper.

June 21st, 1893.

Dr. H. Woodward, F.R.S., Vice-President, in the Chair.

The following names of Fellows of the Society were read out for the second time, in conformity with the Bye-laws, Section VI. Article 5, in consequence of the non-payment of arrears of contributions:—C. A. V. Butler, Esq.; E. M. Cairnes, Esq.; R. W. Cheadle, Esq.; A. W. Clarke, Esq.; W. H. Clarke, Esq.; Lt.-Col. T. Couchman; J. Diggens, Esq.; A. D. Dobson, Esq.; G. S. Griffiths, Esq.; D. W. Jones, Esq.; G. O. Kekewich, Esq.; Dr. A. C. Maybury; J. O'Donoghue, Esq.; S. B. J. Skertchly, Esq.; Dr. J. W. Stroud; G. A. H. Thureau, Esq.; J. Wonnacott, Esq.

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The List of Donations to the Library was read.

The following communications were read :—

1. "On Composite Dykes in Arran." By Prof. J. W. Judd, F.R.S., V.P.G.S.

2. "Notes on an Intrusive Sheet of Diabase and Associated Rocks at Robin Hood, near Bassenthwaite." By J. Postlethwaite, Esq., F.G.S.

3. "On Two Dinosaurian Teeth from Aylesbury." By R. Lydekker, Esq., B.A., F.G.S.

4. "On a new Plesiosaur from the Waipara River, New Zealand." By Capt. F. W. Hutton, F.R.S., F.G.S.

[Abstract.]

This specimen was shortly described by Sir James Hector in 1873. The Author considers it more prudent to follow Mr. Lydekker in referring all the known New Zealand Cretaceous Sauropterygians with which he is acquainted to Leidy's genus *Cimoliosaurus*, and he therefore describes this form as a new species of that genus.

Discussion.

The Chairman remarked that the fossil described by Capt. Hutton, and referred by him to *Cimoliosaurus caudalis*, exhibits the remains of a Plesiosaur from New Zealand showing the pelvic and pectoral girdle and the vertebral column and ribs, but otherwise imperfect. Capt. Hutton had no doubt in his paper justified the proposal to constitute a new species for this Plesiosaur. One must regret that distance prevented the Author from being present to read his own communication.

5. "Observations on the Affinities of the Genus *Astrocœnia*." By Robert F. Tomes, Esq., F.G.S.

6. "Description of a new Genus of Madreporaria from the Sutton Stone of South Wales." By Robert F. Tomes, Esq., F.G.S.

7. "Study of the Dykes of Hope, Idaho." By Herbert R. Wood, Esq. (Communicated by the President.)

[Abstract.]

In this paper a description of the geographical distribution and characters of acid and basic dykes traversing slates and quartzites along the northern shore of Lake Pend'Oreille, Idaho, is accompanied

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by notes on the glaciation of the area. A brief description of the microscopic features of the igneous rocks is appended.

8. "The Rise and Fall of Lake Tanganyika." By Dr. Robert Sieger. (Communicated by the President.)

9. "On Cheilostomatous Bryozoa from the Middle Lias." By Edwin A. Walford, Esq., F.G.S.

The following specimens were exhibited:—

Rock-specimens and microscopic sections, exhibited by Prof. J. W. Judd, F.R.S., V.P.G.S., in illustration of his paper.

Rock-specimens and microscopic sections, exhibited by J. Postlethwaite, Esq., F.G.S., in illustration of his paper.

Dinosaurian Teeth from Aylesbury, exhibited by R. Lydekker, Esq., B.A., F.G.S., in illustration of his paper.

Specimen and section of *Astrocœnia gibbosa* and section from the Society's Collection, and specimens and section, exhibited by R. F. Tomes, Esq., F.G.S., in illustration of his two papers.

Specimens of *Astrocœnia*, exhibited by the Geological Survey in illustration of Mr. Tomes's papers.

A Special General Meeting was held at 7.45 P.M., before the Ordinary General Meeting, at which the following resolutions were proposed by the Chairman, seconded by Mr. Topley, and carried unanimously:—

1. That it is desirable that an Index to the first fifty volumes of the Quarterly Journal be prepared, at an expenditure not exceeding £450.

2. That it be issued, if possible, early in 1895, in two numbers in paper covers, uniform with the Quarterly Journal, and as a Supplement to Volume 50.

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ADDITIONS

TO THE

LIBRARY AND MUSEUM OF THE GEOLOGICAL SOCIETY.

SESSION 1892–93.

ADDITIONS TO THE LIBRARY.

1. PERIODICALS AND PUBLICATIONS OF LEARNED SOCIETIES.

Presented by the respective Societies and Editors, if not otherwise stated.

Adelaide. Royal Society of South Australia. Transactions. Vol. xv. Parts 1 & 2. 1892.

P. H. Priestly. Notes on Glacial Phenomena about Mount Gambier, 123.—G. B. Pritchard. On the Cambrian Rocks at Curramulka, 179.—R. Tate. The Cambrian Fossils of South Australia, 183.—R. Tate. Critical Remarks on A. Bittner's 'Echiniden des Tertiärs von Australien.' 190.

——. ——. ——. Vol. xvi. Part 1. 1892.

Albany. University of the State of New York. New York State Museum. Forty-third Annual Report of the Regents for the year 1889. (8vo.) 1890.

——. ——. ——. Forty-fourth Annual Report of the Regents for the year 1890. (8vo.) 1892.

——. ——. ——. Ninth Report of the State Geologist for the year 1889. 8vo. 1890.

——. ——. ——. Tenth Report of the State Geologist for the year 1890. 1891. *Presented by Prof. James Hall, State Geologist, F.M.G.S.*

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Alnwick. Berwickshire Naturalists' Club. History of the Berwickshire Naturalists' Club, instituted September 22, 1831. 1890–1891. 1892.

Amsterdam. Jaarboek van het Mijnwezen in Nederlandsch Oost-Indië. Jaargang 1892. Technisch en Administratief. 2e gedeelte 1892. *Presented by the Netherlands Colonial Department.*

Austin. Texas Academy of Science. Transactions. Vol. i. No. 1. 1890.

E. T. Dumble. Sources of the Texas Drift, 11.—W. F. Cummins, The Texas Meteorites, 14.—E. T. Dumble. Volcanic Dust in Texas, 33.

Barnsley. Midland Institute of Mining, Civil, and Mechanical Engineers. Proceedings. Vol. xiii. Parts 114–119. 1892–93.

W. H. Chambers. The Pumping Appliances used in the Sinking Operations at the Cadeby New Winning, 43.

Basel. Schweizerische paläontologische Gesellschaft. Abhandlungen. Vol. xix. 1892. 1893. *Purchased.*

P. de Loriol. Etudes sur les mollusques des couches coralligènes inférieures du Jura bernois. IV.e partie.—G. Maillard et A. Locard. Monographie des mollusques tertiaires, terrestres et fluviatiles de la Suisse, II.e partie.—T. Studer. Ueber zwei fossile dekapode Krebse aus den Molasseablagerungen des Belpberges.—R. Hæusler. Notes sur la distribution des Lituolides dans les terrains jurassiques de la Suisse.

Bath. Natural History and Antiquarian Field Club. Proceedings. Vol. vii. Nos. 3 & 4. 1892 & 1893.

H. H. Winwood and E. Wilson. Charles Moore, F.G.S., and his Work; with a List of the Fossil Types and Described Specimens in the Bath Museum, 232.—H. H. Winwood. On some Deep Well Borings in Somerset, 335.

Belfast. Natural History and Philosophical Society. Report and Proceedings for the Session 1891–92. 1893.

Berlin. Deutsche geologische Gesellschaft. Zeitschrift. Band xliv. Hefte 2–3. 1892.

S. von Wöhrmann und E. Koken. Die Fauna der Raibler Schichten vom Schlernplateau, 167.—J. Lemberg. Zur mikrochemischen Untersuchung einiger Minerale, 224.—Von Reinach. Das Rothliegende im Süden und Westen des französischen Centralplateaus, 243.—E. Böse und H. Finkelstein. Die mitteljurassischen Brachiopoden Schichten bei Castel Tesino im östlichen Südtirol, 265.—J. Felix und H. Lenk. Ueber die tektonischen Verhältnisse der Republik Mexico, 303.—J. Kloos. Zur Entstehung des lössartigen Lehmes, 324.—F. Schrodt. Zur Foraminiferen Fauna der weissen Globigerinenmergel von Oran, 329.—H. Eck. *Apeibopsis Laharpii* Heer von St. Margarethen, 332.—H. Potonié. Ueber *Apeibopsis*, 333.—G. Berendt. Das Tertiär bei Falkenberg und Freienwalde a. O., 335.—O. Herrmann. Pseudomorphosen von Eisenglanz nach Biotit im Granitit von Schluckenau, 341.—Rothpletz. Ueber fossile Kalkalgen, 343.—A. Steusloff. Ueber obersilurische, aus dem Ringsjö-Gebiet herzuleitende Geschiebe, 344.—R. Hoernes. Der Querbruch von Santa Croce und die Bildung der Schuttmassen von Cima

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Fadalto und der Rovine di Vedana bei Belluno, 347.—E. Dathe. Zur Frage der Discordanz zwischen Culm und Waldenburger Schichten im Waldenburger Becken, 351.—A. Krause. Neue Ostrakoden aus märkischen Silurgeschieben, 382.—A. Leppla. Ueber das Grundgebirge der pfälzischen Nordvogesen (Hardtgebirge), 400.—P. Oppenheim. Ueber innere Gaumenfalten bei fossilen Cerithien und Melanien, 439.—J. von Siemiradzki. Die oberjurassische Ammoniten-Fauna in Polen, 447.—K. Picard. Ueber *Balatonites sondershusanus*, n. sp., 483.—S. Brusina. Ueber die Gruppe der *Congeria triangularis*, 488.—O. Jaekel. Ueber das Devon in den Vogesen, 498.—P. Oppenheim. Neue Fundpunkte von Binnenmollusken im Vicentinischen Eocän, 500.—T. G. Skuphos. Ueber Hebungen und Senkungen auf der Insel Paros, 504.—E. Böse. Ueber die Schuttmassen der Rovine di Vedana bei Belluno, 507.

Berlin. Königlich preussische Akademie der Wissenschaften. Sitzungsberichte, 1892. Parts 1–55. 1892.

C. Klein. Ueber das Krystallsystem des Apophyllits und Einfluss des Drucks und der Wärme auf seine optischen Eigenschaften, 217.—K. Möbius. Die Behaarung des Mammuths und der lebenden Elephanten, vergleichend untersucht, 527.—C. Rammelsberg. Ueber die Leucit-Nephelingruppe, 543.

——. Zeitschrift für das Berg-, Hütten- und Salinenwesen im preussischen Staate. Band xl. Hefte 3–5. 1892. Abhandlungen.

Marx. Geognostische und bergmännische Mittheilungen über den Bergbaubezirk von Iglesias auf der Insel Sardinien, 102.—C. Minnich. Bergbauliche Mittheilungen von der Westküste Mexikos, 459.—M. Kliver. Ueber die Fortsetzung des Saarbrücker productiven Steinkohlengebirges in der Bayerischen Pfalz, 471.

——. ——. ——. Atlas, Hefte 4–5. 1892.

——. ——. ——. Statistische Lieferung. Hefte 1–3. 1892.

——. ——. Band xli. Heft 1. 1893. Abhandlungen.

L. Brackebusch. Die Bergwerksverhältnisse der Argentinischen Republik, 15.—Köbrich. Ueber einige Messungen der Erdtemperatur im fiscalischen Bohrloche zu Knurow bei Gleiwitz, 50.—M. Landgraf. Eine Diamant-Tiefbohrung in dem bei 269.4 m. Tiefe ersoffenen Schachte, no. 2 der Kaliwerke Aschersleben, Provinz Sachsen, 62.

Berne. Schweizer Alpenclub. Jahrbuch. 26r Jahrgang. 1890 bis 1891. 1891. *Purchased.*

F. A. Forel. Les variations périodiques des glaciers des Alpes, 351.

——. ——. ——. 27r Jahrgang. 1891 bis 1892. 1892. *Purchased.*

F. A. Forel. Les variations périodiques des glaciers des Alpes, 290.

—— (Fribourg). Société Helvétique des Sciences Naturelles. Actes. Compte-rendu, 74me Session, 1890–91. 1892.

M. Musy. Le canton de Fribourg, 1.

Digitized by Google

Birmingham. Mason College, Calendar for the Session 1892–93. 1892.

——. Philosophical Society. Proceedings. Vol. vii. Part 2. Session 1890–91. 1892.

G. Deane. The Future of Geology, 192.—C. Callaway. The Evolution of the Earth's Crust, 241.

——. ——. Vol. viii. Part 1, 1891–92. 1892.

C. Davison. Record of Observations of the Inverness Earthquake of November 15th, 1890, 42.—T. H. Waller. Notes on some Welsh Lavas, 169.

Bordeaux. Société Linnéenne de Bordeaux. Actes. Tome xliv. (Cinquième série: Tome iv.) 1890. 1891.

L. Reyt. L'Etage Cénomanien dans la protubérance crétacée de Saint-Sever, 275.—E. Fallot et L. Reyt. Observations sur le crétacé de Roquefort et ses relations avec quelques assises tertiaires affleurant dans cette localité, 353.—Degrange-Touzin. Procès-verbaux. Sur les Mollasses Helvétiennes de Saint-Symphorien, xix.—Benoist. Sur le gisement fossilifère de Sarcignan (calcaire à astéries), xlv.—Billiot. Sur un puits artésien d'Arveyres, xlviii.—Benoist. Compte-rendu géologique de l'excursion trimestrielle à Bourg et Laussac, l.—L. Reyt. Compte-rendu géologique de l'excursion à Coutras, la Clotte, le Pas-du-Lary et Cercoux, lvi.—L. Reyt. Sur deux espèces du moulin de Gamachot, lxiii.—L. Reyt. Compte-rendu géologique de la 72e Fête Linnéenne, célébrée à Libourne, lxxv.—Benoist et Billiot. Sur la position stratigraphique des couches à Echinides de la faune de Saint-Palais, lxxviii.

Boston. American Academy of Arts and Sciences. Proceedings. Vol. xxvi. 1890–91. 1891.

O. W. Huntington. The Prehistoric and Kiowa County Pallasites, 1.

——. Society of Natural History. Proceedings. Vol. xxv. Parts 3 & 4. 1891–92. 1892.

W. Upham. Recent fossils of the Harbour and Back Bay, Boston, 305.—W. M. Davis. The Catskill Delta in the Post-glacial Hudson Estuary, 318.—A. Hyatt. Remarks on the Pinnidæ, 335.—S. H. Scudder. The Tertiary Rhyncophora of North America, 371.—A. F. Foerste. The Drainage of the Bernese Jura, 392.—W. M. Davis. On the Drainage of the Pennsylvania Appalachians, 418.—E. A. Hartwell. The Pearl Hill Pot-Hole, 421.—Baron Gerard de Geer. On Pleistocene changes of level in Eastern North America, 454.—W. M. Davis. The subglacial origin of certain Eskers, 477.—W. O. Crosby. Geology of Hingham, Mass., 499.

——. ——. Memoirs. Vol. iv. No. 10. 1892.

Buckhurst Hill. Essex Field Club. Essex Naturalist. Vol. vi. Nos. 7–12. 1892.

J. French. On some Plateau Deposits at Felstead and Stebbing, 132.—T. V. Holmes. The Geology of the District around Dagenham Breach, Essex, 142.—W. Crouch. Dagenham Breach, 155.

——. ——. ——. Vol. vii. Nos. 1–5. 1893.

T. V. Holmes. The new Railway between Upminster and Romford, 1.—J. C. Thresh. The Shallow and Deep Well-Waters of Essex, 28.—

Digitized by Google

T. V. Holmes. Excursion of the Geologists' Association to Ilford, 47.—T. V. Holmes. Notes on the Geology of the neighbourhood of Chelmsford, 65.—T. Hay Wilson. Notes on the Gravel in Epping Forest, 74.

Buenos Aires. Instituto Geográfico Argentino. Boletin. Tomo xiii. Cuadernos 7–9. 1892.

——. Sociedad Científica Argentina. Anales. 1892. Tomo xxxiii. Entregas 5, 6. 1892.

——. ——. ——. Tomo xxxiv. Entregas 1–6. 1892.
E. Tornow. Las vertientes de Agua Salada de Tapias, 206.

——. ——. ——. Tomo xxxv. Entrega 1. 1893.

Caen. Laboratoire de géologie de la Faculté des Sciences. Bulletin. Année 1. Nos. 1–7. (8vo.) 1890–92.
A. Bigot. L'Archéen et le Cambrien dans le Nord du Massif breton et leurs équivalents dans le Pays de Galles, 1.—A. Bigot. Esquisse géologique de la Basse-Normandie, 13, 47, 95, 134, 163, 199, 231.—A. Bigot. Les ondulations des couches en Normandie, d'après un récent travail de M. G. Dollfus, 66.—A. Bigot. Revue des Pélécypodes décrits par Defrance dans le Dictionnaire des Sciences Naturelles, d'après les types conservés dans la collection de cet auteur—genre Gryphée, 76, 134.—A. Bigot. Les premiers Reptiles et les premiers Oiseaux, 108.—L. Lecornu et A. Bigot. Sur le gisement des phosphates du plateau d'Orglandes (Manche), 123.—L. Lecornu. Notice explicative de la Feuille de Saint-Lô, 172.—A. Bigot. Sur la position de la couche à *Leptæna* en Normandie et particulièrement à May-sur-Orne, 185.

——. Société Linnéenne de Normandie. Bulletin. Série 4. Vol. vi. Fasc. 1–3. 1892.
O. Lignier. De l'emploi de la vésuvine dans l'étude des végétaux fossiles, 9.—Letellier. Terrains au Sud des Collines de Normandie, 89.—A. Bigot. Compte Rendu des environs géologiques dans les environs de Sées et de Bagnoles, 146.

——. ——. Mémoires. Vol. xvii. (2e Série, 1er vol.) Fasc. 1. 1892.
M. Hovelacque. Recherches sur le *Lepidodendron selaginoides*, Stern., 1.

Calcutta. Asiatic Society of Bengal. Proceedings. 1891. Nos. 7–9. 1891 & 1892.

——. ——. ——. 1892. Nos. 1–9. 1892.

——. ——. Journal. New Series. Vol. lx. Part 2. Nos. 2–4. 1891. 1891 & 1892.

——. ——. ——. New Series. Vol. lxi. Part 2. Nos 1 & 2. 1892.

Cambridge. Cambridge Philosophical Society. Proceedings. Vol. vii. Part 6. 1892.
O. Fisher. On the hypothesis of a liquid condition of the Earth's interior considered in connexion with Prof. Darwin's theory of the genesis of the Moon, 335.

Digitized by Google

Cambridge. Cambridge Philosophical Society. Proceedings. Vol. viii. Part 1. 1893.

——. ——. Transactions. Vol. xv. Part 3. 1892.

Cambridge, Mass. Museum of Comparative Zoology at Harvard College. Annual Report of the Curator for 1891–92. 1892.

——. ——. Bulletin. Vol. xvi. Nos. 11 & 12. 1893.

N. S. Shaler. The Conditions of Erosion beneath Deep Glaciers, based upon a study of the Boulder-train from Iron Hill, Cumberland, R.I., 185. —J. E. Wolff and R. S. Tarr. Acmite Trachyte from the Crazy Mountains, Montana, 227.

——. ——. ——. Vol. xvii. No. 2. 1892.

——. ——. ——. Vol. xxiii. Nos. 4–6. 1892–93.

——. ——. ——. Vol. xxiv. Nos. 1–3. 1893.

Cape Town. South African Philosophical Society. Transactions. Vol. vi. Parts 1 & 2. 1889–92. 1890 & 1892.

H. G. Seeley. Some Scientific Results of a Mission to South Africa, Pt. I., 1.

Chicago. Journal of Geology. Vol. i. Nos. 1 & 2. 1893.

Sir Archibald Geikie. On the Pre-Cambrian Rocks of the British Isles, 1.—W. H. Holmes. Are there traces of Glacial Man in the Trenton Gravels ?, 15.—H. S. Williams. Geology as a part of a College Curriculum, 38.—T. C. Chamberlin. The Nature of the Englacial Drift of the Mississippi Basin, 47.—R. D. Salisbury. Distinct Glacial Epochs and the criteria for their recognition, 61.—C. R. Van Hise. An Historical Sketch of the Lake Superior Region to Cambrian Time, 113.—F. Leverett. The Glacial Succession in Ohio, 129.—W. H. Holmes. Traces of Glacial Man in Ohio, 147.—J. P. Iddings. The Volcanic Rocks of the Andes, 164.—G. H. Williams. On the use of the terms Poikilitic and Micropoikilitic in Petrography, 176.—H. S. Williams. The making of the Geological Time-scale, 180.

Christiania. Nyt Magazin for Naturvidenskaberne. Binds xxxiii. Hefte 3. 1893.

Cincinnati. Society of Natural History. Journal. Vol. xiv. Nos. 3 & 4. 1892.

J. F. James. Manual of the Palæontology of the Cincinnati Group, 149.—S. A. Miller and C. Faber. Description of some Subcarboniferous and Carboniferous Cephalopoda, 164.

——. ——. ——. Vol. xv. Nos. 3 & 4. 1893.

J. F. James. Manual of Palæontology of the Cincinnati Group, 144. —G. P. Grimsley. Microscopical Study of Ohio Limestones, 160.

Colombo. Ceylon Branch of the Royal Asiatic Society. Journal. 1890. No. 39. 1892.

——. ——. ——. 1891. No. 42. 1892.

——. ——. ——. 1892. No. 43. 1893.

Digitized by Google

Copenhagen. Kongelige Danske Videnskabernes Selskab. Fortegnelse, 1742–1891. 1892.

——. ——. Naturvidenskabelige og Mathematiske Afhandlinger. Serie 6. Tome vi. No. 3. 1892.

——. ——. ——. ——. Tome vii. Nos. 5 & 6. 1891–92.

——. ——. Forhandlinger. Oversigt 1891. No. 3. 1892.

——. ——. ——. Oversigt 1892. Nos. 1 & 2. 1892.

Cracow. Akademja Umiejetosci. Pamietnik. Wydziat matematyczno-przyrodniczy. Tomu xviii. Zeszyt 2.

J. Siemiradzki. Fauna kopalna warstw oxfordzkich i kimerydzkich w Polsce, 93.

——. ——. Rozprawy. Wydziat matematyczno-przyrodniczy. Serya 2. Tom. i. 1891.

M. Raciborski. Flora retycka w Tatrach, 243.—T. Wiśniowski. Mikrofauna itow ornatowych okolicy Krakowa, 317.—M. Raciborski. Permokarbońska flora karniowickiego wapienia, 353.

——. ——. ——. ——. ——. Tom. ii. 1892.

W. Szajnocha. Zródta mineralne Galicyi, 30.

Darmstadt. Verein für Erdkunde und die geologische Landesanstalt des Grossherzogthums Hessen. Notizblatt. IV. Folge, 13tes Heft. 1892.

C. Chelius. Das Granitmassiv des Melibocus und seine Ganggesteine, 1.—C. Chelius. Betrachtungen über die Entstehung des Odenwalds, 13.—C. Chelius. Das Pliocaen im Kessel von Michelstadt i. O., 18.—C. Chelius. Ist eine Conchylienfauna des echten Löss bekannt?, 21.—C. Chelius. Mechanische Analyse von Bodenarten des Blattes Rossdorf, 24.—G. Klemm. Die Gliederung des Schwemmlandes am unteren Main, 25.

——. *See* Books: Hesse.

Dijon. Académie des Sciences, Arts et Belles-Lettres. Mémoires. Série 3. Tome i. 1871–73. 1873.

J. Martin. Limon rouge et limon gris, observations sur divers produits d'origine glaciaire, 1.

——. ——. ——. ——. Tome ii. 1874. 1874.

J. Martin. Renseignements complémentaires sur l'époque glaciaire miocène en Bourgogne, 27.

——. ——. ——. ——. Tome iii. 1875–76. 1876.

J. Martin. Des Nodules phosphatés du Gault de la Côte d'Or et des conditions particulières du dépôt de cet étage, 1.—J. Martin. Le groupe Virgulo-portlandien des tranchées de Flacey (Côte d'Or), 17.

——. ——. ——. Série 4. Tome i. 1888–89. 1889.

——. ——. ——. ——. Tome ii. 1890–91. 1891.

J. Martin. Aperçu général de l'histoire géologique de la Côte d'Or, 25.

Digitized by Google

Dorchester. Dorset Natural History and Antiquarian Field Club. Proceedings. Vol. xi. 1890.

J. C. Mansel-Pleydell. Memoir upon a new Ichthyopterygian from the Kimmeridge Clay of Gillingham, Dorset (*Ophthalmosaurus Pleydelli*), 7.—J. C. Mansel-Pleydell. *Histionotus angularis*, 91.—H. S. Solly. The Geology of Bridport, 109.—H. S. Solly and J. F. Walker. Note on the Fault in the Cliff west of Bridport Harbour, 118.

Dorpat. Naturforscher-Gesellschaft bei der Universität Dorpat. Sitzungsberichte. Band ix. Heft 3. 1891. 1892.

——. ——. ——. Band x. Heft 1. 1892.

Marie Pavlow. Note sur un nouveau crâne d'*Amynodon*, 37.

——. ——. Schriften. V. und VI. 1890 & 1891.

Dresden. Königliches mineralogisch-geologisches und prähistorisches Museum. Eilftes Heft. 1892. (4to. Cassel.)

P. Pocta. Ueber Spongien aus der oberen Kreide Frankreichs, mit Vorwort von Dr. H. B. Geinitz, 1.

——. Naturwissenschaftliche Gesellschaft 'Isis.' Sitzungsberichte und Abhandlungen. Jahrgang 1892. Januar bis December. 1892–93.

Abhandlungen.

T. Reibisch. Verzeichniss der bisher in den diluvialen Mergeln von Cotta bei Dresden aufgefundenen Conchylien.—A. B. Meyer. Ueber Bernstein-artiges prähistorisches Material von Sizilien und über Barmanischen Bernstein, 49.—H. B. Geinitz. Bohrversuche für eine neue Wasserwerksanlage auf Tolkewitzer Flur bei Dresden, 58.—E. Zschau. Bemerkungen über den Quarz in Syenite des Plauen'schen Grundes, 60. —W. Bergt. Ueber einen Kieseloolith aus Pennsylvanien, 115.

——. Verein für Erdkunde. XXII. Jahresbericht. 1892.

O. Herz. Berings-Insel, 217.

Dublin. Royal Dublin Society. Scientific Proceedings. N. S. Vol. vii. Parts 3–5. 1892.

W. J. Sollas. On *Homotæchus* (*Archæocidaris Harteana*, Baily), a new Genus of Palæozoic Echinoids, 152.—W. J. Sollas. On the Structure and Origin of the Quartzite Rocks in the neighbourhood of Dublin, 169.—G. A. J. Cole. The Variolite of Annalong, Co. Down, 511.

——. ——. Scientific Transactions. Series 2. Vol. iv. Parts 9–13. 1891–92.

J. W. Davis. On the Fossil Fish-remains of the Coal Measures of the British Islands: Part I. Pleuracanthidæ, 703.

——. Royal Irish Academy. 'Cunningham Memoirs.' No. vii. 1892.

——. ——. Proceedings. Series 3. Vol. ii. No. 3. 1892.

——. ——. Transactions. Vol. xxix. Parts 16–19. 1891–92.

——. ——. ——. Vol. xxx. Parts 1–4. 1892–93.

Digitized by Google

Edinburgh. Royal Physical Society. Proceedings. Session 1891–92. Vol. xi. Part 2. 1893.

R. H. Traquair. Opening Address by the President, 173.—J. Bennie and A. Scott. The Raised Sea-Bottom of Fillyside, 215.—R. Kidston. On two of Lindley and Hutton's Type-Specimens (*Rhacopteris dubia*, L. & H., sp., and *Sphenopteris polyphylla*, L. & H.), 238.—R. Kidston. On a new Species of *Bythotrephis* from the Lower Carboniferous of Lancashire, 241.—J. G. Goodchild. Notes on Carboniferous Lamellibranchs, 244.—J. G. Goodchild. Note on the Genus *Allorisma*, King, 245.

——. Royal Scottish Geographical Society. Scottish Geographical Magazine. Vol. viii. Nos. 7–12. 1892.

James Geikie. Recent Researches in Pleistocene Climate and Geography, 357.—James Geikie. Address to the Geographical Section of the British Association, Edinburgh, 1892, 457.—British Association, 1892, 480.

——. ——. ——. Vol. ix. Nos. 1–6. 1893.

J. C. Ross. Irrigation and Agriculture in Egypt, 169.—H. M. Cadell. Some Ancient Landmarks of Mid-Lothian, 302.

——. Royal Society. Proceedings. Session 1891–92. Vol. xix. (pp. 1–295). 1892–93.

R. W. Felkin. Notes on the Wanyoro Tribe of Central Africa, 136.

——. ——. Transactions. Vol. xxxvi. Nos. 9–23. 1890–91. 1891–92.

J. Y. Buchanan. On the Composition of Oceanic and Littoral Manganese Nodules, 459.—J. W. Gregory. The Maltese Fossil Echinoidea, and their Evidence on the Correlation of the Maltese Rocks, 585.

Frankfurt am Main. Senckenbergische naturforschende Gesellschaft. Bericht, 1891–92. 1892.

W. Schauf. Beobachtungen an der Steinheimer Anamesitdecke, 3.—E. Kinkelin. Altes und Neues aus der Geologie unserer Landschaft, 23.—F. C. Noll. Zwei Beiträge zur Geschichte des Rheinthales bei St. Goar, 71.

——. ——. Lepidopteren von Madagascar. Abth. 1 und 2, von M. Saalmüller und L. von Heyden. (4to.) 1884 & 1891.

Glasgow. Geological Society. Transactions. Vol. ix. Part 2. 1890–91, 1891–93. 1893.

M. F. Heddle. On Pectolite and Okenite from New Localities, 241.—J. S. M'Lennan. The Geology of Kyle, 264.—J. Bennie. Scenes and Sections in Thornton Quarries, East Kilbride in 1868, 276.—J. Dougall. The Leaf-Caves of Mull, 286.—J. Smith. Peculiar U-shaped Tubes in Sandstone near Crawfurdland Castle, and in Gowkha Quarry near Kilwinning, 289.—J. Smith. The Sand-hills of Torrs Warren, Wigtonshire, 293.—J. Young. Notes on the Group of Carboniferous Ostracoda found in the Strata of Western Scotland, 301.—J. Young. Notes on a small group of Carboniferous Foraminifera found in the Lower Limestone Shales of the Muirkirk District in Ayrshire, 313.—R. Dunlop. Note on a "Wash-out" in a Shallow Pit of the Drumshangie Coal Co., near Airdrie, 320.—D. Bell. On the Alleged Proofs of Submergence in Scotland during the Glacial Epoch, 321.—D. Bell. On a Glacial Mound in Glen Fruin, Dumbartonshire, 345.—J. Neilson. A Visit to the Island

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Gloucester. Cotteswold Naturalists' Field Club. Proceedings for 1891–92. Vol. x. Part 3. 1892.

J. H. Taunton. Notes on the Dynamic Geology of Palestine, 323.

Haarlem. Société Hollandaise des Sciences. Hollandsche Maatschappij der Wetenschappen. Archives Néerlandaises des Sciences Exactes et Naturelles. Tome xxv. Livr. 5. 1892.

——. ——. ——. ——. Tome xxvi. Livr. 1–5. 1892–93.

——. ——. ——. Natuurkundige Verhandelingen. 3de Verz. Deel v. 2de Stuk. 1892.

Halifax (N. S.). Nova Scotian Institute of Science. Proceedings and Transactions. Session 1890–91. Series 2. Vol. i. Part 1. 1891.

L. W. Bailey. Notes on the Surface Geology of South-Western Nova Scotia, 1.—E. Gilpin, Jun. Analyses of Nova Scotia Coals and other Minerals, 19.—A. H. MacKay. Pictou Island, 76.

Halle. Kaiserliche Leopoldinisch-Carolinische Deutsche Akademie der Naturforscher. Verhandlungen. (Nova Acta.) Band lv. 1891.

——. ——. ——. (——.) Band lvi. 1891.

J. G. Bornemann. Die Versteinerungen des Cambrischen Schichtensystems der Insel Sardinien, nebst vergleichenden Untersuchungen über analoge Vorkommnisse aus anderen Ländern: Zweite Abtheilung, 425.

Halle (Leipzig). Naturwissenschaftlicher Verein für Sachsen und Thüringen. Zeitschrift für Naturwissenschaften. Band lxv. Heft 6. 1892.

Hanau. Wetterauische Gesellschaft für die gesammte Naturkunde. Bericht, 1889–92. 1893.

A. v. Reinach. Der Untergrund von Hanau, 79.

Helsingfors. Geografiska Föreningens Tidskrift. 4e Årgången, 1892. Nos. 1 & 2. 1892.

——. ——. ——. Nos. 4 & 6. 1892–93.

A. Thesleff. Dawson's Yukon-Expedition, 151.

——. ——. 5e Årgången, 1893. No. 1. 1893.

T. Thoroddsen. Huru Island blef till, 20.

——. Société de Géographie. (Suomen Maatieteellinen Seura.) Fennia. No. 5. 1892.

H. Berghell. Geologiska iakttagelser läng Karelska järnvägen, No. 2.
—H. Berghell. Huru bör Tammerfors-Kangasala åsen uppfattas ?, No. 3.
—W. Ramsay. Kurzer Bericht über eine Expedition nach der Tundra

Digitized by Google

Umptek auf der Halbinsel Kola, No. 7.—A. F. Tigerstedt. Om traktens mellan Hoytiäin och Pielisjärvi geologiska och topografiska byggnad samt några därstades förekommande malmforande kvartsgangar, No. 10.

Helsingfors. Société de Géographie. (Suomen Maatieteellinen Seura.) Fennia. No. 6. 1892.

——. ——. (——.) ——. No. 7. 1892.

J. E. Rosberg. Ytbildningar i ryska och finska Karelen med särskild hänsyn till de karelska Randmoränerna, No. 2.

Hertford. Hertfordshire Natural History Society and Field Club. Transactions. Vol. vi. Parts 8 & 9. 1892.

——. ——. ——. Vol. vii. Parts 2–4. 1892–93.

T. Rupert Jones. Coal: its Nature, Origin, Position, and Extent; and its Range under the South of England, 89.—John Hopkinson. Anniversary Address: Charles Darwin, 101.

Hobart. Royal Society of Tasmania. Papers and Proceedings for 1891. 1892.

R. M. Johnston. Notes on a Collection of Plant Impressions from the Henty River, 11.—F. D. Power. Notes on the Mount Lyell District, 25, 38.—R. M. Johnston. Observations on the Causes of Elevation and Subsidence of the Earth's Crust, 49.

Jena. Paläontologische Abhandlungen. Neue Folge. Band ii. Hefte 1–2. 1892–93. *Purchased.*

K. Futterer. Die oberen Kreidebildungen der Umgebung des Lago di Santa Croce in den Venetianer Alpen, 1.—R. Burckhardt. Ueber *Aepyornis*, 127.

Kiev. Société des Naturalistes de Kiew. Mémoires. Tome xii. Livraisons 1 & 2. 1892.

G. Radkewitsch. Sur les dépôts crétacés du gouvernement de Wolynie, 371.

Kingston. Queen's College and University, Kingston, Canada. Calendar for the year 1893–94. 1893.

Königsberg in Pr. Physikalisch-ökonomische Gesellschaft. Schriften. 32ʳ Jahrgang, 1891. 1891. *Purchased.*

Lausanne. Musée d'Histoire Naturelle. Rapports Annuels des Conservateurs, 1892. 1892. *Presented by Prof. E. Renevier, F.M.G.S.*

——. Société Géologique Suisse. Eclogæ. Vol. iii. No. 3. 1892.

F. Mühlberg. Jura zwischen Aarau und Olten, 181.—L. Rollier. Sur la composition et l'extension du Rauracien dans le Jura, 271.—E. Renevier et M. Lugeon. Géologie du Chablais et Faucigny-Nord, 293.

——. Société Vaudoise des Sciences Naturelles. Bulletin. Sér. 3. Vol. xxviii. Nos. 107–109. 1892.

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—Hans Schardt. Notice sur l'effondrement du quai du Trait de Baye à Montreux, précédée de quelques considérations générales sur la morphologie géophysique des rives lacustres, la formation des cônes de déjection, etc., 232.

Lausanne. Société Vaudoise des Sciences Naturelles. Bulletin. Ser. 3. Vol. xxix. No. 110. 1893.

A. Jaccard. Note sur les niveaux et les gisements fossilifères des environs de Sainte-Croix, 39.—E. Renevier et M. Lugeon. Géologie du Chablais et Faucigny-Nord, 86.—E. Renevier. Note rectificative sur les Belemnites aptiennes, 91.

Leeds Philosophical and Literary Society. Annual Report for 1891–92. 1892.

Leicester Literary and Philosophical Society. Transactions. New Quarterly Series. Vol. ii. Part 12. 1892.

——. ——. ——. Vol. iii. Parts. 1 & 2. 1892 & 1893.

Leipzig (Halle). Naturwissenschaftlicher Verein für Sachsen und Thüringen. Zeitschrift für Naturwissenschaften. Band lxv. Heft 3. 1892.

— Barth. Beiträge zur Geologie von Helmstedt, 107.—D. von Schlechtendal. Ueber das Vorkommen fossiler "Rückenschwimmer" (Notonecten) im Braunkohlengebirge von Rott, 140.

——. Zeitschrift für Krystallographie und Mineralogie. Band xxi. Hefte 1–4. 1893.

A. Schmidt. Daten zur genaueren Kenntniss einiger Mineralien der Pyroxengruppe, 1.—P. Heberdey. Krystallisirte Schlacken von Raibl, 56.—P. Pjatnitzky. Ueber die Krystallform des Uranotil, 74.—K. Zimányi. Ueber den Azurit vom Laurion-Gebirge in Griechenland, 86.—L. J. Igelström. Friedelit aus der Sjögrube, 92.—W. C. Brögger. Sundtit, ein neues Mineral von Oruro in Bolivia, 193.—H. Baumhauer. Krystallographische Notizen, 200.—L. J. Igelström. Melanostibian, ein neues Mineral aus der Manganerzgrube Sjögrufvan, Kirchspiel Grythyttan, Gouvernement Orebro, Schweden, 246.—V. Goldschmidt. Phosgenit von Monteponi, 941.—A. Halm. Topaz von Japan und von Neu Süd-Wales, 334.—F. Stöber. Cölestin von Brousseval, Frankreich, und von Ville-sur-Saulx, 339.—F. Scherer. Studien am Arsenkies, 354.

——. ——. Repertorium der Mineralogischen und Krystallographischen Literatur vom Anfang d. J. 1885 bis Anfang d. J. 1891 und Generalregister der Zeitschrift für Krystallographie und Mineralogie. Bande xi.–xx. Von P. Groth und F. Grünling. I. Theil. (Repertorium, von P. Groth.) 8vo. 1893.

——. Zeitschrift für Naturwissenschaften. Band lxv. Hefte 1 & 2. 1892.

O. Lang. Ueber zeitlichen Bestandwechsel der Vesuvlaven und Aetnagesteine, 1.—H. Erdmann. Ueber das kaukasische Erdöl, 31.

——. ——. Band lxv. Hefte 4 & 5. 1892.

C. Luedecke. Untersuchungen über Gesteine und Böden der Muschelkalkformation in der Gegend von Göttingen, 219.

Digitized by Google

Le Puy. Société d'Agriculture, Sciences, Arts et Commerce du Puy. Annales. Tome xxxiv. 1878–1889. 1890.

Liége. Société Géologique de Belgique. Annales. Tome xviii. Livraison 3. 1890–91. 1892.

Mémoires.

C. de Stefani. Les terrains tertiaires supérieurs du bassin de la Méditerranée (fin), 273.

——. ——. ——. Tome xix. Livraisons 3 & 4. 1891–92. 1892.

Mémoires.

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Lille. Société Géologique du Nord. Annales. Tome xx. 1892. 4e Livraison. 1893.

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——. ——. ——. Tome xxi. 1893. Livraison 1. 1893.

J. Gosselet. Note sur les gîtes du Phosphate de Chaux de Templeux-Bellicourt et de Buire, 2.—J. Roussel. Liste des principales espèces d'Echinides des deux couches à *Echinanthus* de l'Eocène inférieur des Pyrénées, 11.—H. Parent. Notes diverses sur le Terrain crétacé du Nord, 16.—C. Barrois. Légende de la Feuille de Dinan. No. 60, de la Carte géologique de France, au $\frac{1}{80.000}$, 25.—J. Gosselet. Géographie physique du Nord de la France et de la Belgique, 41.—H. Parent. Le Wealdien du Bas-Boulonnais, 50.

Lisbon. Sociedade de Geographia. Boletim. Serie 8. Nos. 11 & 12. 1889.

——. ——. ——. Serie 9. No. 1. 1890.

——. ——. ——. Serie 10. Nos. 6–12. 1891.

——. ——. ——. Serie 11. Nos. 1–8. 1892.

Digitized by Google

Liverpool. Geological Association. Journal. Vol. xii. Session 1891–92. 1892.

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——. Geological Society. Proceedings. Vol. vi. Part 4. 1892.

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London. Annals and Magazine of Natural History. Series 6. Vol. x. Nos. 55–60. 1892. *Purchased.*

A. Smith Woodward. On some Teeth of new Chimæroid Fishes from the Oxford and Kimmeridge Clays of England, 13.—R. v. Lendenfeld. Note on Dr. Hinde's Tertiary Sponge-spicules, 268.

——. ——. ——. Vol. xi. Nos. 61–66. 1893. *Purchased.*

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——. Annals of British Geology, 1891. By J. F. Blake. 8vo. 1892. *Purchased.*

——. Athenæum. (Journal.) Parts 775–780. 1892.

——. ——. (——.) Parts 781–786. 1893.

——. British Association for the Advancement of Science. Report of the Sixty-second Meeting, held at Edinburgh in August, 1892. 1893.

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London. British Association for the Advancement of Science. Excursion Handbook, Edinburgh Meeting. 8vo. Edinburgh, 1892. *Presented by L. L. Belinfante, Esq., B.Sc.*

——. Chemical Society. Journal. Nos. 357–361. 1892.

——. ——. ——. Nos. 362–367. 1893.

C. H. Bothamley. The Mineral Waters of Askern, in Yorkshire, 685.

Digitized by Google

London. East India Association. Journal. Vol. xxiv. Nos. 5–7. 1892.

——. ——. ——. Vol. xxv. Nos. 1–5. 1893.

——. London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science. Series 5. Vol. xxxiv. Nos. 206–211. 1892. *Presented by Dr. W. Francis, F.G.S.*

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——. ——. Vol. xxxv. Nos. 212–217. 1893. *Presented by Dr. W. Francis, F.G.S.*

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——. Geological Magazine. Decade 3. Vol. ix. Nos. 7–12. 1892.

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London. Geological Magazine. Decade 3. Vol. ix. Nos. 7–12. 1892. *Purchased.*

——. ——. ——. Vol. x. Nos. 1–6. 1893.

Eminent Living Geologists: Prof. T. Rupert Jones, 1.—H. Hicks. Some Examples of Folds and Faults in Rocks in the Devonian Rocks near Ilfracombe, 3.—T. M. Reade. The Eskdale Drift and its Bearing on Glacial Geology, 9.—Sir H. H. Howorth. The True Horizon of the Mammoth, 20.—Henry Woodward. Note on a new British species of *Cyclus* from the Coal-measures of Bacup, Lancashire, 28.—H. Bolton. On the Occurrence of a Trilobite in the Skiddaw Slates of the Isle of Man, 29. —R. M. Deeley. The Glacial Succession, 31.—T. M. Reade. Glacial Geology: Old and New, 35.—Memoir on Sir Richard Owen, 50.—R. H. Traquair. On a New Palæoniscid Fish, *Myriolepis Hibernicus*, sp. nov., from the Coal-measures, Co. Kilkenny, Ireland, 54.—G. J. Hinde. On *Palæosaccus Dawsoni*, Hinde, a New Genus and Species of Hexactinellid Sponge from the Quebec Group (Ordovician) at Little Métis, Quebec, Canada, 56.—T. G. Bonney. On the so-called Spilites of Jersey, 59.— F. R. C. Reed. Woodwardian Notes, 64.—J. H. Cooke. On the Occurrence of *Ursus ferox* in the Pleistocene of Malta, 67.—T. M. Reade. Measurement of Geological Time, 97.—F. Chapman. On Oolitic and other Limestones with Sheared Structure from Ilfracombe, 100.—E. Hull. The Submergence of the British Isles during the Glacial Period, 104.— Mark Stirrup. The True Horizon of the Mammoth, 107.—H. Woods. Additions to the Type Fossils in the Woodwardian Museum, 111.—R. H. Traquair. Notes on the Devonian Fishes of Campbelltown and Scaumenac Bay in Canada, 145, 262.—O. C. Marsh. Restorations of *Anchisaurus*, *Ceratosaurus*, and *Claosaurus*, 150.—J. H. Cooke. On the Occurrence of Concretionary Masses of Flint and Chert in the Maltese Limestones, 157.—Sir H. H. Howorth. The True Horizon of the Mammoth, 161.—O. C. Marsh. Restoration of *Mastodon Americanus*, Cuvier, 164. —R. B. Newton. On the Discovery of a Secondary Reptile in Madagascar: *Steneosaurus Baroni* (n. sp.); with a Reference to some Post-Tertiary Vertebrate Remains from the same Country recently acquired by the British Museum (Natural History), 193.—T. Rupert Jones and Henry Woodward. On some Palæozoic Phyllopodous and other Fossils, 198.—T. G. Bonney. On some Quartz-schists from the Alps, 204.—A. Irving. On Post-Eocene Surface-Changes in the London Basin, 211.— C. S. Du Riche Preller. Note on a Coast-Section at the Lizard, 221.— C. S. Du Riche Preller. Note on the Lakes of Zürich and Wallen, 222. —Eminent Living Geologists: Prof. Joseph Prestwich, 241.—Henry Woodward. On Fossils applied as Charms or Ornaments, 246.—F. R. C. Reed. Abnormal Forms of *Spirifera lineata* (Martin), 249.—A. H. Foord and G. C. Crick. On a New Species of *Discites Hibernicus*, from the Lower Carboniferous Limestone of Ireland, 251.—O. Fisher. On the Thickness, Expansion, and Resulting Elevation of Marine Deposits, 254. —J. F. Blake. The Shell-beds of Moel Tryfaen, 267.—A. J. Jukes-Browne. Foraminiferal Limestones from the Grenadine Islands, West Indies, 270.—C. S. Du Riche Preller. Note on the Tuscan Archipelago, 273.—G. Abbot. Was the Deposit of Flint and Chalk Contemporaneous?, 275.—J. D. Hardy. Another View of the Submergence of the British Isles during the Glacial Period, 277.

——. ——. ——. ——. *Purchased.*

——. Geologists' Association. Proceedings. Vol. xii. Parts 8–10. 1892.

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London. Geologists' Association. Proceedings. Vol. xiii. Parts 1 & 2. 1893.

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——. Imperial Institute. Hand-books of Commercial Products. Indian Section. No. 8. Iron. Southern Districts, Madras Presidency. 8vo. Calcutta, 1892. *Presented by the Geological Survey of India.*

——. Institution of Civil Engineers. Minutes of Proceedings. Vol. cviii. 1892.

——. ——. ——. Vol. cix. 1892.

——. ——. ——. Vol. cx. 1892.

——. ——. ——. Vol. cxi. 1893.

——. ——. ——. Brief Subject-index. Vols. lix.-cx. Sessions 1879–80 to 1891–92. 1892.

——. Linnean Society. Journal. Vol. xxix. Botany. Nos. 202–204. 1892–93.

——. ——. ——. Vol. xxiv. Zoology. Nos. 153 & 154. 1892.

——. ——. Transactions. Ser. 2. Botany. Vol. iii. Parts 4–7. 1891–1892.

——. Mineralogical Society. Mineralogical Magazine. Vol. x. Nos. 45, 46. 1891–1892.

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London. Natural Science. Vol. i. Nos. 5–10. 1892. *Purchased.*

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———. ———. Vol. ii. Nos. 11–16. 1893. *Purchased.*

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———. Nature. Vol. xlvi. Nos. 1183–1200. 1892.

E. Reyer. On the Causes of the Deformation of the Earth's Crust, 224.—H. O. Forbes. *Aphanapteryx* and other remains in the Chatham Islands, 252.—W. J. Thomson. Easter Island, 259.—R. Lydekker. The Washington Collection of Fossil Vertebrates, 295.—Sir Archibald Geikie. Inaugural Address, British Association Meeting, 1892, 317.—James Geikie. Opening Address to Section E, 348.—C. Lapworth. Opening Address to Section C, 388.—C. Davison. The Recent Earthquakes, 401.—Geology at the British Association, 428.—Eruption at Sangir, 457.—A. Johnstone. The Passage of Granite Rock into Fertile Soil, 533.—G. Platania. The Recent Eruption of Etna, 542.—L. Fletcher. Geikielite and Baddeleyite, Two New Minerals, 620.

———. ———. Vol. xlvii. Nos. 1201–1226. 1892–93.

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Digitized by Google

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London. Nature. Vol. xlviii. Nos. 1227–1235. 1893.
J. Perry. Seismology in Japan, 136.

——. Palæontographical Society. Memoirs. Vol. xlvi. 1892. 1892. (Two copies.)
H. Alleyne Nicholson. The Stromatoporoids. Part iv.—T. Rupert Jones and H. Woodward. The Palæozoic Phyllopoda. Part ii.—W. H. Hudleston. The Jurassic Gasteropoda. Part i., No. 6.—S. S. Buckman. The Inferior Oolite Ammonites. Part vii.—G. F. Whidborne. The Devonian Fauna of the South of England. Vol. ii., Part 2.

——. Photographic Society of Great Britain. Journal and Transactions. New Series. Vol. xvi. No. 9. 1892.

——. ——. ——. ——. Vol. xvii. Nos. 1–8. 1892–93.

——. Physical Society. Proceedings. Vol. xi. Part 4. 1892.

——. ——. ——. Vol. xii. Part 1. 1893.

——. Quekett Microscopical Club. Journal. Ser. 2. Vol. v. No. 31. 1892.

——. Ray Society. See Books: Buckler, W., and Stainton, H. T., and Cameron, P.

——. Royal Agricultural Society. Journal. Ser. 3. Vol. iii. Parts 3 & 4. 1892.

——. ——. ——. ——. Vol. iv. Part 1. 1893.

——. Royal Astronomical Society. Memoirs. Vol. l. 1890–91. 1892.

——. Royal College of Physicians. List of Fellows, Members, Extra-Licentiates and Licentiates. 1893.

——. Royal Geographical Society. Proceedings. Vol. xiv. Nos. 7–12. 1892.
G. H. Garrett. Sierra Leone and the Interior to the Upper Waters of the Niger, 433.—C. Lapworth. The Heights and Hollows of the Earth's Surface, 688.

——. ——. Geographical Journal. Vol. i. Nos. 1–6. 1892.
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——. Royal Institution of Great Britain. Proceedings, Vol. xiii. Part 3. No. 86. 1893.

Digitized by Google

London. Royal Meteorological Society. Quarterly Journal. Vol. xviii. 1892. Nos. 83 & 84. 1892.

——. ——. ——. Vol. xix. 1893. Nos. 85 & 86. 1893.

——. Royal Microscopical Society. Journal. 1892. Parts 4–6. 1892.

F. Chapman. The Foraminifera of the Gault of Folkestone, 749.

——. ——. ——. 1893. Parts 1 & 2. 1893.

——. Royal Society. Philosophical Transactions. Vol. clxxxi. 1890. Part A. 1891.

——. ——. ——. Vol. clxxxi. 1890. Part B. 1891.

W. C. Williamson. On the Organization of the Fossil Plants of the Coal-measures, 89.

——. ——. ——. Vol. clxxxii. 1891. Part A. 1892.

——. ——. ——. Vol. clxxxii. 1891. Part B. 1892.

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——. ——. ——. Vol. clxxxiii. 1892. Part A. 1893.

——. ——. ——. Vol. clxxxiii. 1892. Part B. 1893.

H. G. Seeley. Researches on the Structure, Organization, and Classification of the Fossil Reptilia.—VII. Further Observations on *Pareiasaurus*, 311.

——. ——. Proceedings. Vol. li. Nos. 310–314. 1892.

J. W. Hulke. On the Shoulder Girdle in Ichthyosauria and Sauropterygia, 471.

——. ——. ——. Vol. lii. Nos. 315–320. 1892.

Sir J. W. Dawson. Supplementary Report on Explorations of Erect Trees containing Animal Remains in the Coal-Formation of Nova Scotia, 4.—J. W. Hulke. On the Shoulder Girdle in Ichthyosauria and Sauropterygia, 233.—E. T. Newton. On some new Reptiles from the Elgin Sandstone, 389.—G. H. F. Ulrich. On a Meteoric Stone found at Makariwa, near Invercargill, New Zealand, 504.

——. ——. ——. Vol. liii. Nos. 321, 322. 1893.

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——. Society of Biblical Archæology. Proceedings. Vol. xiv. Part 8. 1892.

——. ——. ——. Vol. xv. Parts 1–7. 1892–93.

——. Society of Public Analysts. Analyst. Vol. xvii. Nos. 195–200. 1892.

Digitized by Google

London. Society of Public Analysts. Analyst. Vol. xviii. Nos. 201–207. 1893.

——. University College. Calendar. Session 1892–93. 1892.

——. Victoria Institute. Journal of the Transactions. Vol. xxv. Nos. 99 & 100. 1892.
W. Upham. The Post-Glacial Period, 30.

——. ——. ——. Vol. xxvi. Nos. 101–103. 1893.
E. Charlesworth. On the Enigmatical Flint Bodies Bearing the name Paramoudra, and which are only known in the Chalk of Norfolk and Antrim, 209.

——. Year-book of Science. Edited for 1892 by *Prof. T. G. Bonney, D.Sc., LL.D., F.R.S.* 8vo. 1893.

——. ——. ——. ——. *Purchased.*

——. Year-book of the Scientific and Learned Societies of Great Britain and Ireland, comprising list of the papers read during 1891. 8vo. London, 1892. *Presented by H. Bauerman, Esq., F.G.S.*

——. —— 1892. ——, 1893. *Presented by H. Bauerman, Esq., F.G.S.*

——. Zoological Society. Proceedings. 1892. Parts 1–4. 1892–93.
R. Lydekker. On a remarkable Sirenian Jaw from the Oligocene of Italy, and its bearing on the Evolution of the Sirenia, 77.—Sir E. Newton and Hans Gadow. On some bones of the Dodo and other extinct Birds of Mauritius, 543.—R. Lydekker. On Zeuglodont and other Cetacean Remains from the Tertiary of the Caucasus, 558.

——. ——. ——. 1893. Part 1. 1893.
C. J. Forsyth Major. On some Miocene Squirrels, with Remarks on the Dentition and Classification of the *Sciurinæ*, 179.

——. ——. Report of the Council for the year 1892. 1893.

——. ——. Transactions. Vol. xiii. Parts 5 & 6. 1893.
J. W. Gregory. On the British Palæogene Bryozoa, 219.

Lyon. Muséum d'Histoire Naturelle. Archives. Tome v. 1892. *Purchased.*
L. Lortet. Les Reptiles Fossiles du Bassin du Rhône, No. 1.—C. Depéret. La Faune de Mammifères Miocènes de la Grive-Saint-Alban (Isère) et de quelques autres localités du Bassin du Rhône, No. 2.—G. Sayn et W. Kilian. Contribution à l'étude des Céphalopodes Crétacés du Sud-est de la France, No. 3.

Madison. Wisconsin Academy of Sciences, Arts, and Letters. Transactions. Vol. viii. 1888–91. 1892.
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Digitized by Google

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Manchester Geological Society. Transactions. Session 1891–92. Vol. xxi. Parts 14–17. 1892.

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——. ——. ——. Vol. xxi. Part 20. 1892.

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——. ——. ——. Vol. xxii. Parts 1–8. 1892–93.

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——. Literary and Philosophical Society. Memoirs and Proceedings. Series 4. Vol. v. No. 2. 1891–92. 1892.

——. ——. ——. ——. Vol. vi. 1892.

——. ——. ——. ——. Vol. vii. No. 1. 1892–93.

Manchester Museum, Owens College. See Books: Manchester.

Melbourne. Geological Society of Australasia. Transactions. Vol. i. Part 6. 1892.

M. Manson. The Cause of the Ice Age and of Geological Climates, 155.—N. H. Winchell. The Geology of the Iron Ores of Minnesota, U.S.A., 171.—F. D. Power. Notes on the late Landslip in the Dandenong Ranges, Victoria, 181.

Digitized by Google

Melbourne. Royal Society of Victoria. Proceedings. (New Series.) Vol. iv. Part 1. 1892.

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Mexico. Sociedad Científica 'Antonio Alzate.' Memorias y Revista. Vol. vi. 1892–93. Nos. 1 y 2. 1892.

E. Ordóñez. Algunas Obsidianas de México, 33.—F. de Montessus de Ballore. México Séismico, 49.

Minneapolis. American Geologist. Vol. ix. Nos. 1–6. 1892.

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———. ———. Vol. x. Nos. 1–6. 1892.

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Minneapolis. American Geologist. Vol. xi. Nos. 1–5. 1893.

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Montreal. Natural History Society. Canadian Record of Science. Vol. v. Nos. 4 & 5. 1892.

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——. Royal Society of Canada. Proceedings and Transactions for the year 1891. Vol. ix. 1892.

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Moscow. Société Impériale des Naturalistes. Bulletin. N.S. Tome vi. Nos. 2–4. 1892. 1892–93.

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Moscow. Société Impériale des Naturalistes. Bulletin. N.S. Tome vii. No. 1. 1893. 1893.

M. Pavlow. Note sur un crâne d'*Amynodon*, 37.

Munich. Königlich-bayerische Akademie der Wissenschaften. Sitzungsberichte der mathematisch-physikalischen Classe. 1892. Hefte 2–3. 1892–93.

M. v. Pettenkofer. Vorlage von Photographien eines in den Pampas ausgegrabenen grossen diluvialen Säugethieres, 328.

——. ——. ——. 1893. Heft 1. 1893.

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Munich (Cassel). Königlich-bayerisches Oberbergamt, Geognostische Abtheilung. Geognostische Jahreshefte. Vierter Jahrgang, 1891. 1892.

F. v. Sandberger. Uebersicht der Mineralien des Regierungsbezirks Unterfranken und Aschaffenburg, 1.—A. Schwager. Untersuchung von Quell- und Flusswasser aus dem Fichtelgebirge und dem angrenzenden fränkischen Keupergebiete, 35.—T. G. Skuphos. Die stratigraphische Stellung der Partnach- und der sogen. unteren *Cardita*-Schichten in den Nordtiroler und bayerischen Alpen, 87.—O. Reis. Zur Osteologie und Systematik der Belonorhynchiden und Tetragonolepiden, 143.

Nancy. Académie de Stanislas. Mémoires, 1891. Série 5. Tome ix. 1892.

——. Société des Sciences. Bulletin. Série 2. Tome xi. Fasc. 25. 24ème Année. 1891.

Bulletin des Séances.

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——. North of England Institute of Mining and Mechanical Engineers. Transactions. Vol. xxxix. Part 3. 1892.

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——. ——. ——. Vol. xl. Part 5. 1892.

——. ——. ——. Vol. xli. Parts 3–6. 1892–93.

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Newcastle-upon-Tyne. North of England Institute of Mining and Mechanical Engineers. Transactions. Vol. xlii. Parts 1-3. 1893.

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New Haven. American Journal of Science. Series 3. Vol. xliv. Nos. 259–261. 1892.

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———. ———. ———. ———. Nos. 263 and 264. 1892.

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———. ———. ———. Vol. xlv. Nos. 265–270. 1893.

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New Haven. Connecticut Academy of Arts and Sciences. Transactions. Vol. viii. Part 2. 1893.

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———. ———. ———. Vol. ix. Part 1. 1893.

New York. Academy of Sciences. Annals. Vol. vi. Nos. 1–6. 1891–92.

———. ———. Transactions. Vol. xi. Nos. 1–5. 1891–92.

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———. American Museum of Natural History. Bulletin. Vol. iii. No. 2. 1891.

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New York. American Museum of Natural History. Bulletin. Vol. iv. 1892.

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Northampton. Northamptonshire Natural History Society. Journal. Vol. vii. Nos. 49-52. 1892.

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Padua. R. Accademia di Scienze, Lettere, ed Arti in Padova. Atti e Memorie. Anno ccxciii. 1891–92. Nuova Serie. Vol. viii. 1893.

Paris. Académie des Sciences. Comptes-rendus. Tome cxv. Nos. 1–17. 1892.

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Paris. Annales des Mines. Série 9. Tome ii. 6e–12e livraisons de 1892. 1892.

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——. ——. ——. Tome iii. 1e–5e livraisons de 1893. 1893.

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——. Annales Hydrographiques. 2e Série. 1er Volume de 1892. 1892.

——. ——. ——. 2e Volume de 1892. 1892.

——. Annales des Sciences Naturelles. Zoologie et Paléontologie. Série 7. Tome xiii. No. 1. 1892. *Purchased.*

—— ——. ——. Série 7. Tome xiii. Nos. 4–6. 1892. *Purchased.*

——. ——. ——. ——. Tome xiv. Nos. 4–6. 1893. *Purchased.*

——. ——. ——. ——. Tome xv. No. 1. 1893. *Purchased.*

——. Annuaire Géologique Universel. Année 1891. Tome viii. 2e–4e Fascicules. 1892–93.

——. *Dépôt de la Marine.* Annuaire des Marées des Côtes de France pour l'an 1893. 1892.

——. Journal de Conchyliologie. Série 3. Tome xxxii. Nos. 1–4. 1892. *Purchased.*

M. Cossmann. Révision sommaire de la faune du terrain oligocène marin aux environs d'Etampes, 330.

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Paris. Muséum d'Histoire Naturelle. Nouvelles Archives. Série 3. Tome iii. Fasc. 2. 1891.

——. ——. ——. ——. Tome iv. 1892.

——. Société Française de Minéralogie. Tome xvi. Nos. 1 et 2. 1893.

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——. Société Géologique de France. Bulletin. Sér. 3. Tome xviii. 1890. No. 9. 1891.

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Paris. Société Géologique de France. Bulletin. Série 3. Tome xx. 1892. Nos. 1–5. 1892–93.

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Paris. Société Géologique de France. Mémoires. Paléontologie. Tome ii. Fasc. 3. 1891.

J. Seunes. Contribution à l'étude des Céphalopodes du Crétacé supérieur de France. Mémoire No. 2 (suite).—C. Depéret. Les Animaux pliocènes du Roussillon. Mémoire No. 3 (suite).

——. ——. ——. ——. Tome ii. Fasc. 4. 1892.

Douvillé. Études sur les Rudistes, No. 6.

——. ——. ——. ——. Tome iii. Fasc. 3. 1892.

A. Gaudry. Les Pythonomorphes de France, No. 10.

Philadelphia. Academy of Natural Sciences. Journal. Series 2. Vol. ix. Part 3. 1892.

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——. ——. Proceedings. 1892. Parts 2 & 3. 1892.

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——. American Philosophical Society. Proceedings. Vol. xxx. Nos. 138 & 139. 1892.

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Philadelphia. American Philosophical Society. Transactions, N.S., Vol. xvii. Parts 1 & 2. 1892.

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——. Wagner Free Institute of Science. Transactions. Vol. iii. Part 2. 1892.

W. H. Dall. Contributions to the Tertiary Fauna of Florida, with especial reference to the Miocene Silex-beds of Tampa and the Pliocene Beds of the Caloosahatchie River. Part. II., 201.

Plymouth. Devonshire Association for the Advancement of Science, Literature, and Art. Report and Transactions. Vol. xxiv. 1892.

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——. ——. Extra Volume. The Devonshire Domesday. Part ix. 1892.

——. Plymouth Institution and Devon and Cornwall Natural History Society. Annual Reports and Transactions. Vol. xi. Part 2. 1891–92. 1892.

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Rochester, N.Y. Geological Society of America. Bulletin. Vol. 3. 1892.

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Rochester, N.Y. Rochester Academy of Science. Proceedings. Vol. i. Brochure 2. 1891.

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Rome. R. Accademia dei Lincei. Atti. 1889. Serie 4. Memorie. Vol. vi. 1890.

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——. ——. ——. Serie 5. Rendiconti. Vol. i. 1892. 1° Semestre. Fasc. 9–12. 1892.

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Rome. R. Accademia dei Lincei. Atti. Serie 5. Rendiconti. Vol. i. 1892. 2° Semestre. Fasc. 1–12. 1892.

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——. ——. ——. ——. ——. Vol. ii. 1893. 1° Semestre. Fasc. 3–9. 1893.

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——. R. Comitato Geologico d'Italia. Bollettino. Vol. xxii. Nos. 1–4. 1891.

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——. Società Geologica Italiana. Bollettino. Vol. x. Fasc. 3–4. 1891. 1892.

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Rome. Società Geologica Italiana. Bollettino. Vol. xi. 1892. Fasc. 1. 1892.

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——. ——. ——. Vol. xii. 1893. Fasc. 1. 1893.

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Rugby School Natural History Society. Report for the year 1892. 1893.

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St. John, N.B. Natural History Society of New Brunswick. Bulletin. No. 10. 1892.

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St. Petersburg. Académie Impériale des Sciences. Mémoires. Sér. 7. Tome xxxv. Nos. 11–13. 1892.

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——. ——. ——. ——. Tome xxxviii. Nos. 9 & 10. 1892.

——. ——. ——. ——. ——. No. 14. 1892.

——. ——. ——. ——. Tome xl. No. 1. 1892.

J. D. Tscherski. Wissenschaftliche Resultate der von der Kaiserlichen Akademie der Wissenschaften zur Erforschung des Janalandes und der Neusibirischen Inseln in den Jahren 1885 und 1886 ausgesandten Expedition Abth. IV.: Beschreibung der Sammlung Posttertiärer Säugethiere, 1.

Santiago (Chile). Deutscher wissenschaftlicher Verein. Verhandlungen. Band ii. Heft 4. 1892.

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——. Société Scientifique de Chili. Actes. Tome ii. 1892. Livr. 1–3. 1892 & 1893.

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Stockholm. Geologiska Förening. Förhandlingar. Band xv. Häfte 1–2. 1893.

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Stockholm. Geologiska Förening. Förhandlingar. Band xv. Häfte 4. 1893.

O. Nordenskjöld. Om de porfyriska gångbergarterna i östra Småland, 169.—G. Flink. Om några mineral från Grönland, 195.—A. Högbom. Om postarkäiska eruptiver inom det svensk-finska urberget, 209.—A. Högbom. Om de s. k. urgraniterna i Upland, 241.—B. Frosterus. Om en diabas i Fögliö i den åländska skärgården, 275.—H. Hedström. Om hasselns forntida och nutida utbredning i Sverige, 291.—H. Lundbohm. Om berggrunden i Vesternorrlands Kusttrakter, 321.—G. Hallberg. Apophyllit från Grängesberg, 327.

Stuttgart. Neues Jahrbuch für Mineralogie, Geologie und Paläontologie. 1892. Band ii. Hefte 1–3. 1892.

R. Brauns. Albit, Analcim, Natrolith, Prehnit und Kalkspath, Verwitterungs-producte eines Diabases von Friedensdorf bei Marburg, 1.—E. Koken. Ueber die Gastropoden der rothen Schlernschichten, nebst Bemerkungen über Verbreitung und Herkunft einiger triassischer Gattungen, 25.—F. v. Sandberger. Bemerkungen über einige Mineralien aus dem Fichtelgebirge, 37.—A. Kenngott. Ueber die Formel der Turmaline, 44.—H. Traube. Ueber die Krystallform einiger Lithiumsalze, 58.—E. v. Fedorow. Ueber eine merkwürdige Eigenschaft des Anorthit, 68.—E. v. Fedorow. Mikroskopische Beobachtungen der paralleler Lage der Nicols, 69.—R. Burckhardt. Das Gehirn von *Triceratops flabellatus*, Marsh, 71.—J. H. L. Vogt. Ueber die Zusammensetzung der Melilithmineralien, 73.—F. Toula. Geologische Untersuchungen im östlichen Balkan und in anderen Theilen von Bulgarien und Ostrumelien, 75.—F. Toula. Ueber zwei neue Säugethierfundorte auf der Balkanhalbinsel, 77.—A. Leppla. Was ist Ober-Rothliegendes?, 78.—H. Emmons. Hebung der Insel Palmarola, 83.—A. v. Koenen. Ueber südrussisches Unteroligocän, 85.—E. Böse. Ein neues Vorkommen von oberem Lias und unterem Dogger in den bayerischen Alpen, 86.—E. Fraas. Ueber einen neuen Fund von *Ichthyosaurus* in Württemberg, 87.—W. Deecke. Zur Geologie von Unteritalien, 108.—J. Moroziewicz. Ueber die Synthese der Minerale der Hauyn-Gruppe, 139.—E. Hussak. I. Ueber Brazilit; II. Ueber brasilianische Leucitgesteine; III. Nochmals die Leucit-'Pseudokrystall' Frage, 141.—F. von Sandberger. Ein neuer Fund in den Speicksteingruben von Göpfersgrün bei Wunsiedel, 160.—F. von Sandberger. Bemerkungen über einige Tertiärversteinerungen, 160.—A. von Koenen. Ueber die Casseler Tertiärbildungen, 161.—C. W. von Gümbel. Ueber anstehenden Radiolarien-Jaspis in der Schweiz, 162.—C. Klein. Mineralogische Mittheilungen XIII., 165.—K. von Chrustschoff. Ueber künstliche Darstellung des Zirkons auf nassem Wege, 232.—G. Bodländer. Ueber Kobalthaltigen Eisenspath von der Grube Ende im Harteborntal bei Neunkirchen, Kreis Siegen, 236.—R. Brauns. Ueber das Verhalten der Titansäure gegen Phosphorsalz vor dem Löthrohr, 237.—M. Schlosser. Ueber die systematische Stellung der Gattungen *Plesiadapis*, *Protoadapis*, *Pleuraspidotherium* und *Orthaspidotherium*, 238.

——. ——. 1893. Band i. Hefte 1–3. 1893.

Fr. Maurer. Palaeontologische Studien im Gebiet des rheinischen

Digitized by Google

Devon, 1.— G. Bodländer. Die Zusammensetzung des Meliliths, 15.— J. v. Siemiradzki. Zur Geologie von Nord-Patagonien, 22.—H. Credner, E. Geinitz und F. Wahnschaffe. Ueber das Alter des Torflagers von Lauenburg a. d. Elbe, 33.—J. W. Retgers. Ueber krystallinische Schiefer, insbesondere Glaukophanschiefer, und Eruptivgesteine im südlichen Borneo, 39.—H. Rauff. Ueber *Polygonosphaerites*, 43.—A. Streng. Mikrochemische Notizen, 49.—F. v. Sandberger. *Widdringtonia keuperina*, Heer, im untersten Keupergypse bei Windsheim (Mittelfranken), 50.—W. Deecke. Zur Geologie von Unteritalien, 51.— A. Baltzer. Die Etna-Eruption von 1892, 75.—E. Hussak. Ueber Brazilit, 89.—R. Brauns. Berichtigung, 89.—J. W. Retgers. Thalliumsilbernitrate als schwere Schmelze zu Mineraltrennungen, 90.—C. Weber. Vorläufige Mittheilung über neue Beobachtungen an den interglacialen Torflagern des westlichen Holsteins, 94.—F. Toula. Eine marine Fauna aus Mauer bei Wien, 96.—F. Schmidt. Ueber neue silurische Fischfunde, 99.—F. von Sandberger. Die als Erlan bezeichneten Gesteine des Fichtelgebirges, 101.—A. Rothpletz. Stratigraphisches von der Sinaihalbinsel, 102.—Fr. Toula. Zur Geologie der Bucht von Olmütz in Mähren, 105.—W. Ramsay. Ueber die isomorphe Schichtung und die Stärke der Doppelbrechung im Epidot, 111.—F. Graeff und R. Brauns. Zur Kenntniss des Vorkommens körniger Eruptivgesteine bei Cingolina in den Euganeen bei Padua, 123.—A. Leppla. Ueber die Lagerungsform des Remigiusberger Eruptivgesteins, 134.—P. Forcheimer. Versuche über Gleitflächenbildung und Schichtenfaltung, 137. —A. W. Stelzner. Ueber das vermeintliche Vorkommen von Diamant im hindostanischen Pegmatit, 139.

Stuttgart. Neues Jahrbuch für Mineralogie, Geologie und Paläontologie. 1893. Band ii. Heft 1. 1893.

A. Andreae. Ueber die künstliche Nachahmung des Geysirphänomens, 1.—A. Andreae. Intermittirende Springquellen ohne Dampf oder Gasgeysire, 19.—A. Baltzer. Beiträge zur Kenntniss des tunisischen Atlas, 26.—J. Morozewicz. Petrographisch-synthetische Mittheilung, 42.— O. Herman. Krystallskelette von Apatit, 52.—H. Rauff. Ueber angebliche Spongien aus dem Archaicum, 57.—Hosius. Ueber *Zeuglodon*-Reste aus Holland, 68.—E. v. Fedorow. Ueber Universalgoniometer, 69.—A. Kenngott. Zur Formel der Turmaline, 71.—A. Kenngott. Zusammensetzung des Helvin, etc., 72.

——. ——. VIII. Beilage-Band. Hefte 1 & 2. 1892.

G. Steinmann und A. Ulrich. Beiträge zur Geologie und Palaeontologie von Südamerika: I. Palaeozoische Versteinerungen aus Bolivien, 1.— F. Pockels. Ueber die Berechnung der optischen Eigenschaften isomorpher Mischungen aus denjenigen der gemischten reinen, 117.— C. Sarasin. Die Conglomerate und Breccien des Flysch in der Schweiz, 180.—F. Pockels. Ueber die Änderung des optischen Verhaltens von Alaun und Beryll durch einseitigen Druck, 217.—H. Traube. Ueber die Krystallformen optisch einaxiger Substanzen, deren Lösungen ein optisches Drehungsvermögen besitzen, 269.—J. Romberg. Petrographische Untersuchungen an argentinischen Graniten, 275.—F. Pockels. Ueber die elastischen Deformationen piëzoelektrischer Krystalle im elektrischen Felde, 407.

——. Palaeontographica. Band xxxviii. Lief. 1 & 2. 1891. *Purchased.*

J. Böhm. Die Kreidebildungen des Fürbergs und Sulzbergs bei Siegsdorf in Oberbayern, 1.

Digitized by Google

Stuttgart. Palaeontographica. Band xxxix. Lief. 2–6. 1892. *Purchased.*

A. Rothpletz. Die Perm-, Trias- und Jura-Formation auf Timor und Rotti im indischen Archipel, 57.—A. R. Crook. Ueber einige fossile Knochenfische aus der mittleren Kreide von Kansas, 107.—W. Amalizky. Ueber die Anthracosien der Permformation Russlands, 125.—H. Pohlig. Die Cerviden des thüringischen Diluvial-Travertines, mit Beiträgen über andere diluviale und über recente Hirschformen, 215.

——. ——. Band xl. Lief. 1–4. 1893. *Purchased.*

H. Rauff. Paläospongiologie, 1.

——. Verein für vaterländische Naturkunde in Württemberg. Jahreshefte. 48ter Jahrgang. 1892.

F. Braun und K. Waitz. Beobachtungen über die Zunahme der Erdtemperatur, angestellt im Bohrloch zu Sulz am Neckar, 1.—H. Bauer und H. Vogel. Mitteilungen über die Untersuchung von Wassern und Grundproben aus dem Bodensee, 13.—E. Fraas. *Ichthyosaurus numismalis*, E. Fr., 22.—J. F. Pompeckj. Bemerkungen über das Einrollungsvermögen der Trilobiten, 93.—F. Haag. Organische Reste aus der Lettenkohle Rottweils, 234.—A. Schmidt. Erdbebenkommission: Jahresbericht für die Zeit vom 1 März 1891 bis 1 März 1892, 254.

Swansea. South Wales Institute of Engineers. Proceedings. Vol. xvii. No. 6. 1892.

——. ——. ——. Vol. xviii. Nos. 1 & 2. 1892–93.

E. de Villiers Lamb. Notes on the Coal Field of New South Wales, 48.—D. Hannah. Roofs of some of the principal Seams of Coal in the Rhondda Valley and how to treat them, 177.

Sydney. Linnean Society of New South Wales. Proceedings. Vol. vi. Part 4. 1892.

——. ——. ——. Vol. vii. Parts 1–3. 1892–93.

H. Woodward. Note on a new Decapodous Crustacean, *Prosopon Etheridgei*, H. Woodw., from the Cretaceous of Queensland, 301.—R. Etheridge, Jun. Note on Queensland Cretaceous Crustacea, 305.—R. Etheridge, Jun. On *Leaia Mitchelli*, Etheridge fil., from the Upper Coal Measures of the Newcastle District, 307.—J. Mitchell. Note on the Occurrence of certain Fossils in previously unrecorded localities in N.S.W., with Remarks on the Correlation of certain Beds in the Newcastle and Illawarra Districts, 345.

——. Royal Society of New South Wales. Journal and Proceedings. Vol. xxvi. 1892.

J. C. H. Mingaye. Analyses of some of the Well-, Spring-, Mineral, and Artesian Waters of New South Wales, and their probable value for Irrigation and other purposes, 73.—H. G. Smith. Preliminary Note on Limestone occurring near Sydney, 302.—C. W. Marsh. On Native Copper Iodide (Marshite) and other Minerals from Broken Hill, N. S. Wales, 326.—J. C. H. Mingaye. Notes on the occurrence of Platinum, Gold, and Tin in the Beach Sands in the Richmond River District, N.S.W., 368.—J. C. H. Mingaye. Platinum and its Associated Metals in Lode Material at Broken Hill, New South Wales, 371.

Digitized by Google

Taunton. Somersetshire Archæological and Natural-History Society. Proceedings. 1891. Vol. xxxvii. (New Series, Vol. xvii.). 1892.

H. B. Woodward. Notes on the Geology of Crewkerne, 60.

Tokio. College of Science, Imperial University of Japan. Journal. Vol. v. Parts 1–3. 1892–93.

A. Tanakadate and H. Nagaoka. The Disturbance of Isomagnetics attending the Mino-Owari Earthquake of 1891, 149.—B. Koto. The Archæan Formation of the Abukuma Plateau, 197.

——. ——. ——. Vol. vi. Part 1. 1893.

——. Imperial University of Japan. (Teikoku Daigaku.) Calendars for the years 1890–91 and 1891–92. 1891 & 1892.

——. Seismological Journal of Japan. Edited by *John Milne, F.R.S., F.G.S.* Vol. i. 1893.

John Milne. On the Mitigation of Earthquake Effects, and certain Experiments in Earth Physics, 1.—W. K. Burton. On the Application of Photography to Seismology and Volcanic Phenomena, 21.—John Milne. Seismometrical Observations for the year 1890, 31.—John Milne and F. Omori. On the Overturning and Fracturing of Brick and other Columns by horizontally-applied Motion, 59.—John Milne. Earth-Pulsations in relation to certain Natural Phenomena and Physical Investigations, 87.—John Milne. On the Movements of Horizontal Pendulums, 113.—F. Omori. A Note on Early Chinese Earthquakes, 119.—John Milne. A Note on the Great Earthquake of October 28th, 1891, 127.

Toronto. Canadian Institute. Transactions. Vol. ii. Part 2. No. 4. 1892.

W. H. Merritt. Iron and Steel Production in Ontario, 299.—List of Contributions to Geology, including Mineralogy, published in the Transactions of the Canadian Institute, 342.

——. ——. ——. Vol. iii. Part 1. No. 5. 1892.

Truro. Royal Institution of Cornwall. Journal. Vol. xi. Part 2. 1892.

T. Clark. Magnetic Rocks of Cornwall, 280.—J. H. Collins. Origin and Development of Ore-Deposits in the West of England, 327.

Turin. Réale Accademia delle Scienze. Atti. Vol. xxvii. Disp. 9–15 (1891–92). 1892.

F. Sacco. Le zone terziarie di Vernasca e Vigoleno nel Piacentino, 904.

——. ——. ——. Vol. xxviii. Disp. 1–8 (1892–93). 1893.

G. Piotti. Il calcare del Grand Roc (alta valle di Susa), 365.

——. ——. Memorie. Serie 2. Tomo xlii. 1892. Classe di Scienze Fisiche, Matematiche e Naturali.

F. Sacco. I Molluschi dei terreni terziarii del Piemonte e della Liguria, Parte ii., 585.

Digitized by Google

Turin. Reale Accademia delle Scienze. Osservazioni Meteorologiche fatte nell' anno 1891. 1892.

Upsala. Geological Institution of the University of Upsala. Bulletin. Vol. i. 1892. No. 1. 1892.

Hj. Sjögren. Contributions to Swedish Mineralogy, I., 1.—C. Wiman. Ueber das Silurgebiet des Bottnischen Meeres, I., 65.—O. Nordenskjöld. Zur Kenntniss der s. g. Hälleflinten des nordöstlichen Smalands, 76.—J. G. Anderson. Note on the Occurrence of the *Paradoxides ölandicus*-zone in Nerike, 82.

Vienna. Kaiserliche Akademie der Wissenschaften. Denkschriften. Mathematisch-naturwissenschaftliche Classe. Band lviii. 1891.

C. Frh. v. Ettingshausen. Die fossile Flora von Schoenegg bei Wies in Steiermark, 283.—L. R. v. Höhnel, A. Rosiwall, F. Toula, und E. Suess. Beiträge zur geologischen Kenntniss des östlichen Africa, 447.

——. ——. Sitzungsberichte. Mathematisch-naturwissenschaftliche Classe. Abtheilung i. Band c. Hefte 1–9. 1891.

R. v. Lendenfeld. Das System der Kalkschwämme, 4.—G. Tschermak. Die Chloritgruppe, 29.—C. Frh. von Ettingshausen. Ueber tertiäre *Fagus*-Arten der südlichen Hemisphäre, 114.—H. B. Foullon. Ueber Gesteine und Minerale von der Insel Rhodus, 144.—L. Szajnocha. Ueber einige carbone Pflanzenreste aus der Argentinischen Republik, 203.—G. Bukowski. Kurzer Vorbericht über die Ergebnisse der in den Jahren 1890 und 1891 im südwestlichen Kleinasien durchgeführten geologischen Untersuchungen, 378.—F. Kasser. Ueber die fossile Flora der rhätischen Schichten Persiens, 413.—F. K. v. Marilaun. Die Verschiebungen der Wasserscheide im Wippthale während der Eiszeit, 448.

——. ——. ——. ——. Abtheilung i. Band ci. Hefte 1–6. 1892.

G. Bukowski. Die geologischen Verhältnisse der Umgebung von Balia Maaden im nordwestlichen Kleinasien (Mysien), 214.—F. Becke. Vorläufiger Bericht über den geologischen Bau und die krystallinischen Schiefer des Hohen Gesenkes (Altvatergebirge), 286.—A. Bittner. Ueber Echiniden des Tertiärs von Australien, 331.—E. v. Mojsisovics. Vorläufige Bemerkungen über die Cephalopoden-Fauna der Himalaya-Trias, 372.—J. Wiesner. Ueber den mikroskopischen Nachweis der Kohle in ihren verschiedenen Formen, und über die Uebereinstimmung des Lungenpigments mit der Russkohle, 379.—F. Toula. Zwei neue Säugethierfundorte auf der Balkanhalbinsel, 608.

——. Kaiserlich-königliche Bergakademie zu Leoben und Přibram und Königlich-ungarische Bergakademie zu Schemnitz. Berg- und Hüttenmännisches Jahrbuch. Band xl. Hefte 1–4. 1892.

A. Aigner. Der Salzbergbau in den österreichischen Alpen, 203.

——. ——. ——. Band xli. Heft 1. 1893.

——. Kaiserlich-königliche geologische Reichsanstalt. Abhandlungen. Band xvii. Hefte 1 & 2.. 1892.

Leopold von Tausch. Ueber die Bivalvengattung *Conchodus* und *Conchodus Schwageri*, n. f., aus der obersten Trias der Nordalpen, Heft 1.—A. Bittner. Brachiopoden der Alpinen Trias, Nachtrag I., Heft 2.

Digitized by Google

Vienna. Kaiserlich-königliche geologische Reichsanstalt. Jahrbuch. 1892. Band xlii. Hefte 1-4. 1892-93.

H. B. v. Foullon. Ueber Goldgewinnungsstätten der Alten in Bosnien, 1.—C. v. John. Ueber die chemische Zusammensetzung der Pyrope und einiger anderer Granate, 53.—A. Hofmann. Beiträge zur miocänen Säugethierfauna der Steiermark, 63. — A. Bittner. Neue Arten aus der Trias von Balia in Kleinasien, 77.—M. Vacek. Einige Bemerkungen zum Kartenblatte Lundenburg-Göding, 113.—C. v. John und H. B. v. Foullon. Technische Analysen und Proben aus dem chemischen Laboratorium der k. k. geologischen Reichsanstalt, 155.—St. Zareczny. Ueber die Stratigraphie des Karniowicer Kalkes, 179.—H. B. v. Foullon. Ueber einige Nickelerzvorkommen, 223.—H. Höfer. Das Miocän bei Mühldorf in Kärnten, 311.—R. Trampler. Die Loukasteine, 325.—J. Dreger. Ueber einige Versteinerungen der Kreide- und Tertiär-Formation von Corcha in Albanien, 337.—C. v. John. Ueber die chemische Zusammensetzung verschiedener Salze aus den k. k. Salzbergwerken von Kalusz und Aussee, 341.—J. J. Jahn. Zur Frage über die Bildung des Erdöls, 361.—W. Waagen. Vorläufige Mittheilung über die Ablagerung der Trias in der Salt-range (Punjab), 377.—A. Bittner. Was ist norisch?, 387.—J. J. Jahn. Beiträge zur Stratigraphie und Tektonik der mittelböhmischen Silur-Formation, 397.—M. Kříž. Die Höhlen in den mährischen Devonkalken und ihre Vorzeit, 463.—E. Böse, Die Fauna der liasischen Brachiopodenschichten bei Hindelang (Algäu), 627.—F. Katzer. Ueber eine Kalkeinlagerung in den glimmerigen Grauwackenschiefern 2 *c* des böhmischen Untersilurs, 651.—V. Pollack. Der Bergsturz im 'grossen Tobel' nächst Langen (Arlberg) am 9. Juli 1892, 661.

——. ——. Verhandlungen. 1892. Nos. 6-18. 1892.

R. Hoernes. Schöckelkalk und Semriacher Schiefer, 144. — St. Zareczny. Ueber eine Prioritätsfrage in der Literatur des Karniowicer Kalkes, 159.—E. Tietze. Zur Literatur des Karniowicer Kalkes, 164.—J. J. Jahn. Ueber die Pyropensande in Nordböhmen, 168.—H. Keller. Petrefaktenfunde am Bisamberg und bei Nussdorf, 170.—B. v. Foullon. Mineralogische Notizen, 171.—A. Bittner. Petrefakten des marinen Neogens von Dolnja Tuzla in Bosnien, 180.—G. A. Koch. Die im Schlier der Stadt Wels erbohrten Gasquellen, nebst einigen Bemerkungen über die obere Grenze des Schliers, 183.—G. Stache. Photographische Aufnahme geologischer Specialobjecte und Landschaftstypen in Kärnten und in der Umgebung von Triest, 192.—G. Bukowski. Einige Bemerkungen über die pliocänen Ablagerungen der Insel Rhodus, 196.—A. Bittner. Daten über zwei neue Brunnenbohrungen in den Gaswerken Döbling und Fünfhaus, 214.—J. Blaas. Beiträge zur Geologie von Tirol, 217.—A. Bittner. Ueber die systematische Stellung von *Mactra* und verwandten Gattungen, 232.—A. Bittner. Ueber zwei für die Nummulitenkalke von Stockerau neue Arten, 241.—R. Hoernes. Neue Schildkrötenreste aus steierischen Tertiärablagerungen, 242.—J. Blaas. Bericht über dem am 9. Juli 1892 bei Langen am Arlberg niedergegangen Bergsturz, 261.—A. Fellner. Nochmals die Welser Gasbrunnen, 266.—H. Lechleitner. Eine neue Lagerstätte dioritischer Gesteine bei Vahrn am Eisak, im Spiluker Thale, 277.—F. Teller. Die carbonischen Ablagerungen im Gebiete des Wotschberges in Südsteiermark, nebst Bemerkungen über das Alter der sie umrandenden Kalke und Dolomite, 281.—A. Rosiwal. Aus dem krystallinischen Gebiete zwischen Schwarzawa und Zwittawa, 288.—A. Bittner. Ein Vorkommen petrefaktenführender Partnachschichten im Ennsthale in Oberösterreich, 301.—A. Bittner. Aus den Umgebungen von Opponitz,

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Vienna. Kaiserlich-königliche geologische Reichsanstalt. Verhandlungen. 1893. Nos. 1–5. 1893.

G. Stache. Jahresbericht 1892, 1.—R. Hoernes. Zur Geologie von Untersteiermark: X. Die Fischfauna der Cementmergel von Tüffer, 41.—S. Brusina. *Congeria ungula capræ* (Münst.), *C. simulans*, Brus. n. sp., und *Dreissensia Münsteri*, Brus. n. sp., 45.—V. Pollack. Der Bergsturz im 'grossen Tobel' nächst Langen am Arlberg vom 9. Juli 1892, 49.—G. Geyer. Vorlage des Blattes 'St. Michael' (Zone 17, Col. IX.), 49.—C. M. Paul. Vorlage des Kartenblattes Znaim (Zone 10, Col. XIV.), 65.—A. Bittner. Geologische Mittheilungen aus dem Gebiete des Blattes: Z. 14, Col. XII. Gaming-Mariazell, 65.—W. Salomon. Ueber den geologischen Bau und die Fossilien der Marmolata, 89.—J. Blaas. Diluvialtorf bei Hopfgarten, 91.—A. Rosiwal. Ueber einen neuen Aufschluss in den Pötzleinsdorfer Sanden, 91.—J. Dreger. Ueber die geologischen Verhältnisse der Umgebung des Wotsch- und Donatiberges in Südsteiermark, 92.—G. A. Kock. Neue Tiefbohrungen auf brennbare Gase im Schlier von Wels, Grieskirchen und Eferding in Oberösterreich, 101.—A. Rosiwal. Ueber einige Mineralvorkommen aus dem böhmisch-mährischen Grenzgebirge, 130.—G. v. Bukowski. Ueber den Bau der südlichen Sudetenausläufer östlich von der March, 132.

——. Kaiserlich-königliches naturhistorisches Hofmuseum. Annalen. Band vii. Nos. 3 & 4. 1892.

E. Cohen. Meteoreisen-Studien II., 143.

——. ——. ——. Band viii. No. 1. 1893.

G. Linck. Ueber das Krystallgefüge des Meteoreisens, 113.

——. Kaiserlich-königliche zoologisch-botanische Gesellschaft. Verhandlungen. Jahrgang 1892. Band xlii. Quartal 1–4. 1892–93.

Warwick. Warwickshire Natural History and Archæological Society. Report, 1893. 1893. *Presented by the Rev. P. B. Brodie, M.A., F.G.S.*

Digitized by Google

Washington. Smithsonian Institution. Bureau of Ethnology. Seventh Annual Report of the Bureau of Ethnology to the Secretary of the Smithsonian Institution, 1885–86. 1891.

——. ——. ——. Bibliography of the Athapascan Languages, by J. C. Pilling. 8vo. 1892.

——. ——. Smithsonian Contributions to Knowledge. Vol. xxviii. 4to. 1892.

——. ——. United States National Museum. Annual Report for the year ending June 30, 1890. 1891.

G. P. Merrill. Handbook for the Department of Geology in the U.S. National Museum, Part I., 503.

——. ——. ——. Bulletin. No. 40. 8vo. Washington, 1892.

——. ——. ——. ——. No. 42. A Preliminary Descriptive Catalogue of the Systematic Collections in Economic Geology and Metallurgy in the United States Museum. By F. P. Dewey. (8vo.) 1891.

Wellington (N. Z.). New Zealand Institute. Transactions and Proceedings. 1891. Vol. xxiv. 1892.

F. W. Hutton. The Moas of New Zealand, 93.—A. Hamilton. Notes on Moa Gizzard-stones, 172.—A. Hamilton. On the Genus *Aptornis*, with more especial reference to *Aptornis defossor*, Owen, 175.—H. O. Forbes. Preliminary Notice of Additions to the Extinct Avifauna of New Zealand, 185.—F. W. Hutton. On the Foliated Rocks of Otago, 359.—F. W. Hutton. Note on the Boulders in the Port Hills, Nelson, 365.—H. Shrewsbury. The Auckland Volcanoes, 366.—J. Park. On the Prospects of finding Workable Coal on the Shores of the Waitemata, 380.—J. Park. On the Occurrence of Native Zinc at Hape Creek, Thames, 384.—J. Park. On the Occurrence of Native Silver at the Thames Goldfield.—T. White. On the Native Dog of New Zealand, 540.—H. C. Field. Discoveries of Moa bones, 558.—H. C. Field. On the Shifting of Sand-dunes, 561.—H. C. Field. On Earthquakes in the Vicinity of Wanganui, 569.—G. Hogben. Notes on the Earthquake of the 24th June, 1891, 574.—G. Hogben. Notes on the Earthquake of the 5th July, 1891, in Cook Strait, 577.—C. Malfroy. On Geyser-action at Rotorua, 579.—H. Hill. Ruapehu and Ngauruhoe, 603.

Wellington College Natural Science Society. 22nd Annual Report, 1891. 1892. *Presented by Horace W. Monckton, Esq., F.L.S., F.G.S.*

——. 23rd Annual Report, 1892. 1893. *Presented by Horace W. Monckton, Esq., F.L.S., F.G.S.*

Wiesbaden. Nassauischer Verein für Naturkunde. Jahrbücher. Jahrgang xlv. 1892.

York. Natural History Journal. Vol. xvi. No. 138. 1892.

——. ——. Vol. xvi. Nos. 141–144. 1892.

——. ——. Vol. xvii. Nos. 145–149. 1893.

C. Sowden. To the Tasmanian Tin-Mines, 6.—J. E. Clark. The Earliest Mammals, 38.

——. Yorkshire Philosophical Society. Annual Report of the Council for 1891. 1892.

Digitized by Google

2. Books.

Names of Donors in Italics.

Admiralty. *Hydrographic Department.* China Sea. Report on the Results of Dredgings obtained on the Macclesfield Bank by H.M.S. 'Penguin,' Commander W. U. Moore, R.N., April 1892. By P. W. Bassett-Smith. 4to. London, 1893.

Alabama. Geological Survey. (*Eugene A. Smith*, State Geologist.) Bulletin No. 2. On the Phosphates and Marls of Alabama, by the State Geologist. 8vo. Montgomery, Ala., 1892.

——. ——. (——.) Bulletin No. 3. A Preliminary Report on a Part of the Lower Gold Belt of Alabama, by W. B. Phillips. 8vo. Montgomery, Ala., 1892.

——. ——. (——.) Bulletin No. 4. Report on the Geology of North-eastern Alabama and adjacent portions of Georgia and Tennessee, by C. W. Hayes. 8vo. Montgomery, Ala., 1892.

Albarellos, N., F. Solier, P. Banon, R. Wolff, y C. Imperiale. Pozo Artesiano de Barracas. 8vo. Buenos Aires, 1862. *Presented by F. J. R. Carulla, Esq.*

Alsace-Lorraine. Abhandlungen zur Geologischen Specialkarte. Band v. Hefte 1 und 2. 8vo. Strassburg, 1892 und 1893. *Purchased.*

Amalizky, W. Ueber die Anthracosien der Permformation Russlands. 4to. Stuttgart, 1892.

——. Ueber Süsswasser-Lamellibranchiata aus den carbonischen Bildungen des Donetz Beckens. 8vo. St. Petersburg, 1893.

Ameghino, F. Répliques aux critiques du Dr. Burmeister sur quelques genres de Mammifères fossiles de la République Argentine. 8vo. Buenos Aires, 1892.

Andersson, J. G. Note on the occurrence of the *Paradoxides ölandicus*-zone in Nerike. 8vo. Upsala, 1893.

——. Ueber das Alter der *Isochilina canaliculata*-Fauna. 8vo. Stockholm, 1893.

Anon. The Midford Fuller's Earth Refining Works, near Bath. 8vo. Bath, 1887. *Presented by H. B. Woodward, Esq., F.G.S.*

——. (B.C.Y.) The Remote Antiquity of Man not proven. 8vo. London, 1882. *Purchased.*

Arcidiacono, S. See *Ricco, A.*

Army Medical Department. Report for the year 1890. 8vo. London, 1892.

Aveline, W. T. *See* Great Britain.

Digitized by Google

Baden. Ministerium des Innern. Mittheilungen der Grossherzoglich Badischen Geologischen Landesanstalt. Band 2. Heft 3. 8vo. Heidelberg, 1892. *Purchased.*

Banon, P. *See* Albarellos, N.

Bassett-Smith, P. W. *See* Admiralty.

Bather, F. A. The Natural History of the Crinoidea. 8vo. London, 1890.

——. Some Alleged Cases of Misrepresentation. 8vo. London, 1891.

——. The Fossil Crinoidea in the British Museum. 8vo. London, 1892.

Bayley, W. S. A Summary of Progress in Mineralogy and Petrography in 1891. 8vo. Waterville, Me., 1892.

——. A Summary of Progress in Mineralogy and Petrography in 1892. 8vo. Waterville, Me., 1893.

Beecher, C. E. Development of the Brachiopoda. Part II. 8vo. New Haven, 1892.

——. Revision of the Families of Loop-bearing Brachiopoda. 8vo. New Haven, Conn., 1893.

——. The Development of *Terebratalia obsoleta*, Dall. 8vo. New Haven, Conn., 1893.

——. *See* Dodge, W. W.

Bell, F. J. *See* British Museum.

Belowsky, M. *See* Reiss, W.

Bergeron, J. See *Janet, C.*

Bergt, W. Ueber einen Kieseloolith aus Pennsylvania. 8vo. Dresden, 1892. *Presented by Dr. H. B. Geinitz, F.M.G.S.*

Bernard, F. Éléments de Paléontologie. 1re partie. 8vo. Paris, 1893. *Purchased.*

Binnie, A. R. London County Council. Report of the Chief Engineer on the Flow of the Thames. 4to. London, 1892.

Blake, J. F. Catalogue of the Collection of Metallurgical Specimens formed by the late John Percy, Esq., M.D., F.R.S., now in the South Kensington Museum. With an Introduction by Professor Roberts-Austen. 8vo. London, 1892.

——, *and Thomas Leighton.* Excursion to the Isle of Wight. 8vo. London, 1891.

Blomefield, L. Remarks on the Distribution and Movements of British Animals and Plants in Past and Present Times, as instanced in the Nightingale and some other cases. 8vo. Bath, 1892.

Digitized by Google

Boettger, O. Katalog der Batrachier-Sammlung im Museum der senckenbergischen naturforschenden Gesellschaft in Frankfurt am Main. 8vo. Frankfurt a. M., 1892.

Bohemia. *Landesdurchforschungs Comité.* Archiv der naturwissenschaftlichen Landesdurchforschung von Böhmen. Band vi. No. 1. 8vo. Prag, 1891.
F. Sitenský. Ueber die Torfmoore Böhmens, 1.

——. ——. ——. Band vii. No. 2. 8vo. Prag, 1889.
A. Frič. Studien im Gebiete der böhmischen Kreideformation. Die Teplitzer Schichten, 1.

——. ——. ——. Band vii. No. 3. 8vo. Prag, 1890.
J. Hanamann. Ueber die chemische Zusammensetzung verschiedener Ackererden und Gesteine Böhmen's und über ihren agronomischen Werth, 1.

——. ——. ——. Band vii. No. 4. 8vo. Prag, 1891.
J. Krejčí. Geologische Karte von Böhmen. Section vi. Mit Erläuterung von A. Frič. (Massstab $\frac{1}{200000}$.)

——. ——. ——. Band viii. No. 1. 8vo. Prag, 1891.

Bonney, T. G. On the so-called 'Gneiss' of Carboniferous age at Guttannen, Canton Berne, Switzerland. 8vo. London, 1892.

——. Petrological Notes on the Euphotide or Saussurite-smaragdite Gabbro of the Saasthal. 8vo. London, 1892.

——. Note on the Nufenenstock (Lepontine Alps). 8vo. London, 1893.

——. On some Schistose 'Greenstones' and allied Hornblendic Schists from the Pennine Alps, as illustrative of the Effects of Pressure-metamorphism. 8vo. London, 1893.

——. On a Secondary Development of Biotite and of Hornblende in Crystalline Schists from the Binnenthal. 8vo. London, 1893.

Boule, M. See *Gaudry, A.*

Breton, L. Étude sur l'étage carbonifère du Bas-Boulonnais. 8vo. Saint-Etienne, 1891.

British Museum. Catalogue of the British Echinoderms in the British Museum (Natural History), by F. Jeffrey Bell. 8vo. London, 1892. *Presented by the Trustees.*

Brodie, P. B. President's Address, 1892, to the Warwickshire Naturalists' and Archæologists' Field Club. 1892.

——. Reminiscences of a Search for Fossil Insects: Where and How to find them. 8vo. Warwick, 1892.

Brough, Bennett H. On Mine Surveying. (Cantor Lectures.) 8vo. London, 1892.

Brown, H. Y. L. *See* South Australia.

Digitized by Google

Brown, J. Allen. On the Continuity of the Palæolithic and Neolithic Periods. 8vo. London, 1892.

Bruhns, W. *See* Rath, G. v.

Brusina, Spiridion. Fossile Binnen-Mollusken aus Dalmatien, Kroatien und Slavonien. 8vo. Agram, 1874. *Presented by Prof. T. Rupert Jones, F.R.S., F.G.S.*

——. Fauna Fossile Terziaria di Markusevec in Croazia. 8vo. Zagreb (Agram), 1892. *Presented by Prof. T. Rupert Jones, F.R.S., F.G.S.*

Buckler, W., and H. T. Stainton. The Larvæ of the British Butterflies and Moths. Vol. v. 8vo. London, 1893. (*Ray Society.*)

Buckman, S. S. Vererbungsgesetze und ihre Anwendung auf den Menschen. 8vo. Leipzig, 1893.

——, *and F. A. Bather.* The Terms of Auxology. 8vo. Leipzig, 1892.

Burton, W. K. *See* Milne, J.

Busz, K. *See* Rath, G. v.

Cameron, A. C. G. Excursion to Woburn Sands and Sandy. 8vo. London, 1892.

——. On the Continuity of the Kellaways Beds over extended Areas near Bedford, and on the Extension of the Fuller's-Earth Works at Woburn. 8vo. London, 1892.

Cameron, P. A Monograph of the British Phytophagous Hymenoptera (Cynipidæ and Appendix). Vol. iv. 8vo. London, 1893. (*Ray Society.*)

Canada. *Geological and Natural History Survey.* Catalogue of Canadian Plants. Part vi., Musci, by John Macoun. 8vo. Montreal, 1892.

——. ——. Contributions to Canadian Micro-Palæontology. Part iv., by D. Rust. 8vo. Montreal, 1892.

——. ——. Contributions to Canadian Palæontology. Vol. i., by J. F. Whiteaves. Part iv., 6. The Fossils of the Devonian Rocks of the Islands, Shores, or immediate vicinity of Lakes Manitoba and Winnipegosis. 8vo. Ottawa, 1892.

Capellini, G. Commemorazione del Socio Sir Riccardo Owen. 4to. Rome, 1893.

Carez, L. France. [Extrait de l'Annuaire Géologique Universel, 1890.] 8vo. Paris, 1892.

——. Grande Bretagne. [Extrait de l'Annuaire Géologique Universel, 1890.] 8vo. Paris, 1892.

Digitized by Google

Carez, L. Jurassique. [Extrait de l'Annuaire Géologique Universel, 1890.] 8vo. Paris, 1892.

——. Revue annuelle de Géologie. [Revue Générale des Sciences.] 8vo. Paris, 1892.

Carruthers, G. T. The Cause of Gravity. 8vo. Inverness, 1892.

Cayeux, L. Composition minéralogique des Sables glauconieux landéniens. 8vo. Lille, 1891.

——. Diffusion des trois formes distinctes de l'Oxyde de Titane dans le crétacé du Nord de la France. 8vo. Lille, 1891.

——. La Craie du Nord de la France et la Boue à Globigérines. 8vo. Lille, 1891.

——. La Craie du Nord est bien du Dépôt terrigène; et sur un Calcaire moderne concrétionné avec Diatomées de Saint-Nectaire-le-Bas (Puy-de-Dôme). 8vo. Lille, 1891.

——. Sur l'existence d'un gisement de Blende et de Galène dans le département du Nord. 8vo. Lille, 1891.

——. Notes sur la Glauconie. 8vo. Lille, 1892.

Chapman, F. On Oolitic and other Limestones with Sheared Structure from Ilfracombe. 8vo. London, 1893.

Choffat, P. *See* Portugal.

Clark, W. B. The Surface Configuration of Maryland. 4to. Baltimore, Md., 1893.

Clarke, J. M. *See* New York.

Claypole, E. W. The Continents and the Deep Sea. 8vo. Rochester, N.Y., 1891.

——. Traces of the Ice Age in the Flora of the Cuyahoga Valley. 8vo. Cleveland, Ohio, 1891.

——. On the Structure of the American Pteraspidian *Palæaspis* (Claypole), with Remarks on the Family. 8vo. London, 1892.

——. The Head of *Dinichthys*. 8vo. Rochester, N.Y., 1892.

Cole, G. A. J. County Dublin, Past and Present. 8vo. Dublin, 1892.

——. Aids in Practical Geology. 2nd edition. Revised. 8vo. London, 1893.

Collins, J. H. On the Origin and Development of Ore Deposits in the West of England. Part ii. 8vo. ——, 1892.

Digitized by Google

Collins, J. H. Seven Centuries of Tin Production in the West of England. 8vo. Truro, 1892.

——. A Working List of the Palæozoic Fossils of Cornwall. 8vo. Penzance, 1893.

Corneliussen, O. A. *See* Norway.

Cortese, E. *See* Italy.

Cotteau, G. Les Délégués des Sociétés Savantes à la Sorbonne en 1890. 8vo. Auxerre, 1890.

——. Paléontologie Française. Terrains Tertiaires. Écocène, Échinides. Tome ii. Livr. 21–25. 8vo. Paris, 1890–92.

——. Échinides nouveaux ou peu connus. 9e Article. 8vo. Paris, 1891.

——. La Géologie au Congrès de Limoges en 1890. 8vo. Auxerre, 1891.

——. Les Échinides Éocènes de la Loire-Inférieure et de la Vendée. 8vo. Nantes, 1891.

——. Note sur le genre *Echinolampas*. 8vo. Paris, 1891.

——. Notice sur l'*Hemipneustes oculatus* (Drapiez), Cotteau, de la Craie de Ciply et les autres espèces du genre *Hemipneustes*. 8vo. Brussels, 1891.

——, A. Péron, et G. Gauthier. Échinides fossiles de l'Algérie. Dixième Fascicule. Étages Miocène et Pliocène. 8vo. Paris, 1891.

Crane, Agnes. Recent Researches in the Anatomy and Development of the Brachiopoda. 8vo. London, 1892.

——. Sir Richard Owen's Researches on the Invertebrata. 8vo. London, 1893.

——. The Distribution and Generic Evolution of some Recent Brachiopoda. 8vo. London, 1893.

Credner, H. Ueber die geologische Stellung der Klinger-Schichten. 8vo. Leipzig, 1892.

——. The Geological Survey of the Kingdom of Saxony. 8vo. Leipzig, 1893.

Crouch, E. A. An Illustrated Introduction to Lamarck's Conchology. 4to. London, 1827. *Purchased.*

Cuénot, L. See *Janet, C.*

Dahll, T. *See* Norway.

Digitized by Google

Dakyns, J. R. *See* Great Britain.

Dall, W. H. Determination of the Dates of Publication of Conrad's 'Fossils of the Tertiary Formation' and 'Medial Tertiary.' 8vo. Washington, 1893.

Daubrée, A. Notice sur Nicolas de Kokscharow. 8vo. Paris, 1893.

Davis, J. W. On the Fossil Fish-remains of the Coal Measures of the British Islands. Part I. Pleuracanthidæ. 4to. Dublin, 1892.

Davis, W. M. The Lost Volcanoes of Connecticut. 8vo. New York, 1891. *Presented by W. Whitaker, Esq., F.R.S., F.G.S.*

Day, D. T. *See* United States.

Delano, W. H. Twenty Years' Practical Experience of Natural Asphalt and Mineral Bitumen. 8vo. London, 1893.

Delebecque, A. Atlas des Lacs Français. Fol. Paris, 1893.

Dewalque, G. Observations sur la corrélation des diverses bandes considerées comme frasniennes par M. Stainier. 8vo. Liége, 1892.

Diller, J. S. Geology of the Taylorville Region of California. 8vo. Rochester, N.Y., 1892.

——. Mica-peridotite from Kentucky. 8vo. New Haven, Conn., 1892.

Dodge, W. W., and *C. E. Beecher.* On the Occurrence of Upper Silurian Strata near Penobscot Bay, Maine. 8vo. New Haven, Conn., 1892.

Doelter, C. Edelsteinkunde. 8vo. Leipzig, 1893. *Purchased.*

Dollfus, G. F. Relations stratigraphiques de l'Argile à Silex. 8vo. Paris, 1891.

——. Bryozoaires. [Annuaire Géologique Universel, 1890.] 8vo. Paris, 1892.

——. Cœlentérés, Spongiaires, Foraminifères, Radiolaires. [Annuaire Géologique Universel, 1890.] 8vo. Paris, 1892.

——. Crustacés Inférieurs. [Annuaire Géologique Universel, 1890.] 8vo. Paris, 1892.

——. Groupe Quaternaire. [Annuaire Géologique Universel, 1890.] 8vo. Paris, 1892.

Douglas, James. Biographical Sketch of Thomas Sterry Hunt. 8vo. Am. Inst. Mining Eng., 1892.

Digitized by Google

Dresden. Kgl. Mineralogisch-Geologisches und Praehistorisches Museum (Nachtrag zu dem Führer durch dasselbe). 8vo. Dresden, 1892. *Presented by Dr. H. B. Geinitz, F.M.G.S.*

Dumble, E. T. *See* Texas.

Dunn, E. J. *See* Victoria.

Duparc, L., et L. Mrazec. La Structure du Mont-Blanc. 8vo. Geneva, 1893.

——, ——. Sur quelques Bombes volcaniques de l'Etna des Éruptions de 1886 et 1892. 8vo. Geneva, 1893.

——, ——. Sur un Schiste à Chloritoïde des Carpathes. 8vo. Paris, 1893.

Dutch East Indies. *See* Periodicals. Amsterdam.

Edinburgh Museum of Science and Art. (Science and Art Department.) Guide to Gallery containing Geological Survey and other Collections illustrative of Scottish Geology and Mineralogy. 8vo. Edinburgh, 1892. *Presented by L. L. Belinfante, Esq., B.Sc.*

England and Wales. Geological Survey. *See* Great Britain and Ireland.

Etheridge, R., Jun. *See Jack, R. L.*, and South Australia.

Felix, J., und H. Lenk. Ueber die tektonischen Verhältnisse der Republik Mexiko. 8vo. Berlin, 1892.

Finland. *Geologiska Undersökning.* Beskrifning till Kartbladet. Nos. 18–21. 8vo. Helsingfors, 1890, 1891, 1892.

Fisher, O. Appendix to the Second Edition of 'Physics of the Earth's Crust.' 8vo. London, 1891.

——. On Theories to account for Glacial Submergence. 8vo. London, 1892.

——. The Hypothesis of a Liquid condition of the Earth's Interior considered in connexion with Professor Darwin's theory of the genesis of the Moon. 8vo. Cambridge, 1892.

——. On the Thickness, Expansion, and Resulting Elevation of Marine Deposits. 8vo. London, 1893.

Florence. Comune di Firenze. Relazione della Commissione incaricata dello studio di un nuovo acquedotto Fiorentino. 4to. Florence, 1893. *Presented by Prof. Igino Cocchi, F.C.G.S.*

Forel, F. A. Le Léman. 2 vols. 8vo. Lausanne, 1892. *Purchased.*

Fox-Strangways, C. *See* Great Britain.

Digitized by Google

France. *Dépôt de la Marine.* Catalogue par ordre géographique des Cartes, Plans, Vues de Côtes, &c. 8vo. Paris, 1893.

——. Ministère des Travaux Publics. Bulletin des Services de la Carte Géologique de la France et des Topographies Souterraines. Tome iv. 1892–93. Nos. 28–31. 8vo. Paris, 1892. *Purchased.*

——. *Ministère des Travaux Publics.* Etudes des Gîtes Minéraux de la France. Bassin Houiller et Permien de Brive. Fasc. i. Stratigraphie, par Georges Mouret. 4to. Paris, 1891.

——. ——. ——. ——. Fasc. ii. Flore Fossile, par R. Zeiller. 4to. Paris, 1892.

Frazer, Persifor. Thomas Sterry Hunt, M.A., D.Sc., LL.D. F.R.S. [Obituary Notice.] 8vo. Minneapolis, 1893.

Frič, A. *See* Bohemia.

Fritsch, A. Fauna der Gaskohle und der Kalksteine der Permformation Böhmens. Band iii. Heft 2. 4to. Prag, 1893.

Gaudry, A. Excursion dans l'Amérique du Nord. 8vo. Paris, 1891.

——. L'*Ichthyosaurus Burgundiæ.* 8vo. Autun, 1892.

——. Les Pythonomorphes de France. 4to. Paris, 1892.

——, *et M. Boule.* Matériaux pour l'Histoire des Temps Quaternaires. Fasc. 4. 4to. Paris, 1892.

Gauthier, G. See *Cotteau, G.*

Gilbert, G. K. Continental Problems. 8vo. Rochester, 1893.

——. The Moon's Face. A Study of the Origin of its Features. 8vo. Washington, 1893.

Gilpin, Edwin, Jun. Minerals of Nova Scotia. 8vo. Halifax, N.S., 1893.

——. The Use of Safe Explosives in Coal Mines. 8vo. —, 1893.

——. *See* Nova Scotia.

Glocker, E. F. Geognostische Beschreibung der preussischen Oberlausitz, theilweise mit Berücksichtigung des sächsischen Antheils. (With Maps.) 8vo. Görlitz, 1857. *Purchased.*

Goodchild, J. G. Some Observations upon the Natural History of Gypsum. 8vo. London, 1889.

——. The Helm Wind. 8vo. Carlisle, 1889.

——. The History of the Eden and of some Rivers adjacent. 8vo. Carlisle, 1889.

——. An Outline of the Geological History of Upper Swaledale. 8vo. Birmingham, 1890.

Digitized by Google

Goodchild, J. G. Excursion to Edenside. 8vo. London, 1890.

——. Notes on some Observed Rates of Weathering of Limestones. 8vo. London, 1890.

——. On some of the Modes of Formation of Coal Seams. 8vo. Edinburgh, 1890.

——. Notes on some of the Limestones of Cumberland and Westmorland. 8vo. Carlisle, 1891.

——. How to take Impressions of Fossils. 8vo. London, 1892.

——. Note on a Granite Junction in the Ross of Mull. 8vo. London, 1892.

——. Notes on the Coniston Limestone Series. 8vo. London, 1892.

——. Notes on the Glacial Phenomena of Upper Ribblesdale. 8vo. Birmingham, 1892.

——. Notes on the Water Supply of Edenside. 8vo. Carlisle, 1892.

——. Observations on the New Red Series of Cumberland and Westmorland, with especial reference to classification. 8vo. Carlisle, 1892.

——. The St. Bees Sandstone and its Associated Rocks. 8vo. London, 1892.

——. Notes on the Construction of Topographical Models. 8vo. Edinburgh, 1893.

——. See *Monckton, Horace W.*

Great Britain and Ireland. Geological Survey. England and Wales. Memoirs. The Geology of the Country around Wigan, by E. Hull and J. W. Salter. 8vo. London, 1862.

——. ——. ——. ——. (93 S.W.) The Geology of the Carboniferous Rocks north and east of Leeds, and the Permian and Triassic Rocks about Tadcaster. By W. T. Aveline, A. H. Green, J. R. Dakyns, J. C. Ward, and R. Russell. 8vo. London, 1870.

——. ——. ——. ——. (87 S.W.) The Geology of the neighbourhood of Wakefield and Pontefract, by A. H. Green and R. Russell. 8vo. London, 1879.

——. ——. ——. ——. The Jurassic Rocks of Britain. Vols. i. & ii. Yorkshire. By C. Fox-Strangways. 8vo. London, 1892. *Presented by the Director-General.*

——. ——. Ireland. Explanatory Memoirs to accompany Sheets 1, 2, 5, 6 & 11; 3, 4, 5, 9, 10, 11, 15 & 16; 7 & 8; 12;

Digitized by Google

13; 14; 17; 18; 19; 20; 21, 28 & 29; 22, 23, 30 & 31; 24; 26; 27; 31 & 32; 33; 34; 35; 37, 38 & 29; 39, 40, 51 & 62; 41, 53 & 64; 42 & 43; 44; 45; 46; 47; 48; 49, 50 & 61; 54 & 42; 55; 56; 58; 59; 60 & 71; 60, 61 & 71; 62 & 73; 63 & 74; 65; 66 & 67; 68 & 69; 70; 75; 76 & 77; 78, 79 & 80; 81 & 82; 83 & 84; 86, 87 & 88; 91 & 92; 93 & 94; 95; 96, 97, 106 & 107; 103, 104 & 113; 105 & 114; 115 & 116; 117 & 118; 120; 121 & 130; 126; 127; 127 n. ed.; 129; 133; 135; 136; 137; 138 & 139; 154; 158 & 159; 169, 170, 180 & 181; 185 & 186; 187, 195 & 196; 188 & 189; 192 & 199; 193; 197 & 198; 134. 8vo. Dublin. (Various dates.) *Presented by the Director-General.*

Great Britain and Ireland. Geological Survey. Ireland. List of Papers published on the Geology of the North of Ireland and adjoining Districts, arranged by E. T. Hardman. 8vo. Dublin, 1872. *Presented by the Director-General.*

——. ——. Scotland. Memoirs. Explanation of Sheet 76. Central Aberdeenshire. 8vo. Edinburgh, 1890. *Presented by the Director-General.*

——. ——. Mineral Statistics for the years 1853 and 1854, 1856, 1859, 1860, 1861, Appendix to 1861, 1864, 1865, 1866, 1874. 8vo. London, 1855–75. *Presented by the Director-General.*

——. Home Office. Mineral Statistics for the years 1882, 1883, 1884. 4to. London, 1883–85. *Presented by the Mining Record Office.*

——. Mines and Minerals. Mineral Statistics of the United Kingdom of Great Britain and Ireland, with the Isle of Man, for the year 1892. 4to. London, 1893. *Presented by the Secretary of State for the Home Department.*

——. Mines. List of the Plans of Abandoned Mines deposited in the Home Office. Corrected to 31st December, 1892. 4to. London, 1893. *Presented by Dr. C. Le Neve Foster, F.R.S., F.G.S.*

——. ——. Year 1892. Summaries of the Statistical Portion of the Reports of Her Majesty's Inspectors of Mines. 4to. London, 1893. *Presented by Dr. C. Le Neve Foster, F.R.S., F.G.S.*

Green, A. H. *See* Great Britain and *Whitaker, W.*

Gresley, W. S. Note on Anthracite 'Coal-Apples' from Pennsylvania. 8vo. [Am. Inst. Mining Engineers.] 1893.

Digitized by Google

Groth, P. Uebersichtstabelle der 32 Abtheilungen der Krystallformen, mit Erläuterungen, Beispielen, und graphischer Darstellung nach Gadolin. 8vo. Leipzig, 1892. *Purchased.*

Gümbel, C. W. von. Ueber anstehenden Radiolarien-Jaspis in der Schweiz. 8vo. Stuttgart, 1892.

——. Geologische Mittheilungen über die Mineralquellen von St. Moritz in Oberengadin und ihre Nachbarschaft, nebst Bemerkungen über das Gebirge bei Bergün und die Therme von Pfäfers. 8vo. Munich, 1893.

——. *See* Dresden.

Gunn, John, M.A., F.G.S., Memorials of, being some account of the Cromer Forest-Bed and its Fossil Mammalia, and of the associated Strata in the Cliffs of Norfolk and Suffolk, from the MS. notes of the late John Gunn; with a Memoir of the Author. Edited by Horace B. Woodward, F.G.S., with the assistance of E. T. Newton, F.G.S. 8vo. Norwich, 1891. *Presented by Mrs. Gunn through Horace B. Woodward, Esq., F.G.S.*

Gwinnell, W. F. The Rhætic Deposits of Britain: being a chapter of Geological History. 8vo. ——?

Hall, J. See New York.

Hanamann, J. *See* Bohemia.

Hardman, E. T. *See* Great Britain.

Harlé, E. Le Repaire de Roc-Traücat (Ariège) et notes sur les Mégacéros, Castors, Hyènes, Saïgas et divers Rongeurs Quaternaires du Sud-ouest de la France. 8vo. Toulouse, 1892.

——. Les Brèches à Ossements de Montousse (Hautes-Pyrénées), suivi d'appendices sur des Équidées, Rhinocéros, Bovidées et Marmottes Quaternaires du Sud-ouest de la France. 8vo. Toulouse, 1892.

Harrington, H. *See* Texas.

Harrison, W. J. Proposal for a National Photographic Record and Survey. 8vo. London, 1892.

Hatch, F. H. Text-book of Petrology. 8vo. London, 1892. *Purchased.*

——. *See* Posewitz, T.

Haushofer, K. Leitfaden für die Mineralbestimmung. 8vo. Braunschweig, 1892. *Purchased.*

Helland, A. *See* Norway.

Henry, James. Æneidea. Indices. 8vo. Meissen, 1892. *Presented by Dr. James Henry's Trustees.*

Digitized by Google

Herrick, C. L. *See* Minnesota.

Herries, R. S. See *Monckton, Horace W.*

Hesse. *Grossherzogliches Ministerium des Innern. Geologische Landesanstalt zu Darmstadt.* Erläuterungen zur geologischen Karte. Lief. II., Blatt Darmstadt. 8vo. Darmstadt, 1891.

——. ——. ——. ——. Lief. II., Blatt Mörfelden. 8vo. Darmstadt, 1891.

——. *See* PERIODICALS. Darmstadt.

Heusser, J. C., y G. Claraz. Ensayos de un conocimiento geognostico-fisico de la Provincia de Buenos Aires. I. La Cordillera entre el cabo Corrientes y Tapalqué. 8vo. Buenos Aires, 1863. *Presented by F. J. R. Carulla, Esq.*

Hill, R. T. Notes on the Texas-New Mexican Region. 8vo. Rochester (N.Y.), 1891.

——. Preliminary Notes on the Topography and Geology of Northern Mexico and South-west Texas, and New Mexico. 8vo. Minneapolis, 1891.

——. The Geologic Evolution of the non-mountainous Topography of the Texas Region. 8vo. Minneapolis, 1892.

——. The Cretaceous Formations of Mexico and their relations to North American Geographic Development. 8vo. New Haven, Conn., 1893.

——. The Deep Artesian Boring at Galveston, Texas. 8vo. New Haven, Conn., 1893.

——. The Occurrence of Hematite Iron Ores in Mexico. With notes on the Associated Igneous Rocks by W. Cross. 8vo. New Haven, Conn., 1893.

——. *See* Texas.

Hinde, G. J. On *Palæosaccus Dawsoni*, Hinde, a new Genus and Species of Hexactinellid Sponge from the Quebec Group (Ordovician) at Little Métis, Quebec, Canada. 8vo. London, 1893.

Hodson, G. A Consideration of some of the Conditions requisite for obtaining Underground Water Supplies. 8vo. Loughborough, 1893.

Hoernes, R. Erdbebenkunde. 8vo. Leipzig, 1893. *Purchased.*

Holmes, T. V. The New Railway between Upminster and Romford. 8vo. Buckhurst Hill, 1893.

Hopkinson, John. Charles Darwin. An Address. 8vo. Hertford, 1893.

——. *See* Royal Commission on Metropolitan Water Supply.

Digitized by Google

Howley, J. P. The Mineral Resources of Newfoundland. 8vo. St. John's, N.F., 1892.

——. ——. ——. *Presented by the Secretary of State for the Colonies.*

——. *See* Newfoundland.

Hudleston, W. H., and E. Wilson. A Catalogue of British Jurassic Gasteropoda, comprising the Genera and Species hitherto described, with references to their Geological Distribution and to the Localities in which they have been found. 8vo. London, 1892. (Two copies.)

Hull, E. How the Waters of the Ocean became Salt. 8vo. London, 1893.

——. *See* Great Britain.

Hume, W. F. Notes on Russian Geology. 8vo. London, 1892.

Hutchinson, H. N. Deep Sea Deposits. 4to. London, 1893.

——. Extinct Monsters. 8vo. London, 1892.

Hutton, F. W. The Moas of New Zealand. 8vo. Wellington, N.Z., 1892.

Imperiale, C. *See* Albarellos, N.

India. *Geological Survey.* Memoirs. Contents and Index of the Twenty Volumes 1859–1883, by W. Theobald. 8vo. Calcutta, 1892.

——. ——. ——. Palæontologia Indica. Index up to 1891, by W. Theobald. 4to. Calcutta, 1892.

——. ——. Records. Vol. xxv. Parts 2–4. 1892.

——. ——. ——. Vol. xxvi. Part 1, 1893. 1893.

——. ——. *See also* Periodicals. London. Imperial Institute.

Ireland. Geological Survey. *See* Great Britain and Ireland.

Irving, A. The Bagshot Beds of Bagshot Heath (a rejoinder). 8vo. Wellington College, 1892.

Italy. R. Ufficio Geologico. Memorie descrittive della Carta Geologica d'Italia. Vol. vii. Descrizione geologico-petrografica delle Isole Eolie da E. Cortese e V. Sabatini. 8vo. Rome, 1892.

——. ——. ——. Vol. viii. Descrizione geologico-mineraria dei dintorni di Massa Marittima in Toscana da B. Lotti. 8vo. Rome, 1893.

Jack, Robert L. *See* Queensland.

—— *and Robert Etheridge, Jun.* The Geology and Palæontology of Queensland and New Guinea, with Sixty-eight Plates and a Geological Map of Queensland. 8vo. Brisbane, 1892.

Digitized by Google

Jackson, James. Socotra. 8vo. Paris, 1892.

——. Tableau de Diverses Vitesses exprimées en Mètres par Seconde. 8vo. Nice, 1893.

Jacquot, E. Études géologiques sur le Bassin Houiller de la Sarre, faites en 1847, 1848 et 1850. 8vo. Paris, 1853. *Purchased.*

James, J. F. Manual of the Palæontology of the Cincinnati Group. Parts iii. & iv. 8vo. Cincinnati, 1892–93.

——: The Preservation of Plants as Fossils. 8vo. Cincinnati, 1892.

Janet, C. Note sur un *Echinocorys carinatus* présentant neuf pores génitaux. 8vo. Paris, 1890.

——. Note sur les conditions dans lesquelles s'est effectué le Dépôt de la Craie dans le Bassin Anglo-Parisien. 8vo. Paris, 1891.

——. Note sur trois nouvelles Bélemnites sénoniennes. 8vo. Paris, 1891.

——, *et J. Bergeron.* Excursions géologiques aux environs de Beauvais. 8vo. Beauvais, 1883.

——, *et L. Cuénot.* Note sur les orifices génitaux multiples. 8vo. Paris, 1891.

Jannettaz, E. Notice sur les Travaux Scientifiques de, 4to. Paris, 1892.

——. Nouvelles recherches sur la propagation de la chaleur dans les corps cristallisés, et notes sur les grenats noirs des Pyrénées. 8vo. Paris, 1892.

Jervis, W. P. Riccardo Owen. 4to. Florence, 1893.

John, C. v. Ueber den Moldavit oder Bouteillenstein von Radomilic in Böhmen. 8vo. Vienna, 1889.

——. Natürliches Vorkommen von Humussäure in dem Falkenauer Kohlenbecken. 8vo. Vienna, 1891.

——. Ueber die chemische Zusammensetzung des sogenannten Taraspits von Vulpera bei Tarasp in der Schweiz und der Miemite überhaupt. 8vo. Vienna, 1891.

——. Ueber die chemische Zusammensetzung der Pyrope und einiger anderer Granate. 8vo. Vienna, 1892.

——. Ueber die chemische Zusammensetzung verschiedener Salze aus den k. k. Salzbergwerken von Kalusz und Aussee. 8vo. Vienna, 1892.

Jones, T. Rupert. Biographical Notice of. [Extract from the Geological Magazine.] 8vo. London, 1892.

Digitized by Google

Jones, T. Rupert. Coal: its nature, origin, position, and extent; and its range under the South of England. 8vo. Hertford, 1893.

——, *and Henry Woodward.* A Monograph of the British Palæozoic Phyllopoda (*Phyllocarida*, Packard). Part ii. Some Bivalved and Univalved Species. 4to. London, 1892.

Jukes-Browne, A. J. The Building of the British Isles. Second edition. 8vo. London, 1892.

——. The Student's Handbook of Physical Geology. Second edition. Revised. 8vo. London, 1892.

Kalteyer, G. H. *See* Texas.

Katzer, F. Geologie von Böhmen. 8vo. Prag, 1889–92. (With map, $\frac{1}{720,000}$. *Purchased.*

Kayser, E. Beiträge zur Beurtheilung der Frage nach einer einstmaligen Vergletscherung des Brockengebietes. 8vo. Berlin, 1892.

——. Beiträge zur Kenntniss der Fauna der Siegenschen Grauwacke. 8vo. Berlin, 1892.

——. Text-book of Comparative Geology. Translated and Edited by *Philip Lake.* 8vo. London, 1893.

Kendall, J. D. The Iron Ores of Spain. 8vo. Newcastle-on-Tyne. 1892.

Kjerulf, T. See- und Thalbildung: vier Beispiele aus Norwegen. 8vo. Halle a. S., 1881. *Purchased.*

Knop, A. Der Kaiserstuhl im Breisgau. 8vo. Leipzig, 1892.

——. ——. ——. *Purchased.*

Koenen, A. von. Das Norddeutsche Unter-Oligocän und seine Mollusken-Fauna. . Lief. 4. 8vo. Berlin, 1892.

——. Ueber die Fauna der alt-tertiären Schichten im Bohrloche von Lichterfelde bei Berlin. 8vo. Berlin, 1892.

Krasnopolsky, A. *See* Russia.

Krejčí, J. *See* Bohemia.

Kroustchoff, K. de. Note sur une inclusion d'une eucrite à enstatite dans le basalte de Wingendorf près de Laban en Silésie, 8vo. Paris, 1887.

——. Sur de nouveaux procédés de reproduction artificielle de la silice cristallisée et de l'orthose. 4to. Paris, 1887.

——. Ueber künstlichen Magnesiaglimmer. 8vo. Vienna, 1887.

——. Beiträge zur Petrographie Volhyniens und Russlands. 8vo. Vienna, 1888.

Digitized by Google

Kroustchoff, K. de. Notice sur la granulite variolitique de Foni, près de Ghittorrai (Sardaigne). 8vo. Paris, 1888.

——. Liste des Principaux Travaux Minéralogiques, Géologiques, Pétrographiques et Chimiques de. 8vo. St. Pétersbourg, 1891.

——. Russische Albite. 8vo. Stuttgart, 1891.

——. Sur la formation de la Toungouska Pierreuse (Sibérie septentrionale). 4to. Paris, 1891.

——. Sur la théorie des feldspaths de M. Tschermak. 4to. Paris, 1891.

——. Ueber das Gestein der Insel Walamo im Ladogasee. 8vo. Stockholm, 1891.

——. Ueber ein neues aussereuropäisches Leucitgestein. 4to. St. Petersburg, 1891.

——. Ueber ein paläozoisches Leucitgestein. 8vo. Stuttgart, 1891.

——. Ueber künstliche Hornblende. 8vo. Stuttgart, 1891.

——. Vorläufige Mittheilung über die von Herrn J. Lopatin an der Steinigen (Podkamennaja) Tunguska gesammelten Gesteine. 4to. St. Petersburg, 1891.

——. Ueber zwei neue Mineralsynthesen. 4to. St. Petersburg, 1892.

Kuch, R. *See* Reiss, W.

Lacroix, A. Minéralogie de la France et de ses Colonies. Tome i. 1re Partie. 8vo. Paris, 1893. *Purchased.*

Lake, Philip. See *Kayser, E.*

Landero, C. F. Sinopsis Mineralógica, ó catálogo descriptivo de los minerales. 8vo. Mexico, 1891.

Lapparent, A. de. Les Anciens Glaciers. 8vo. Paris, 1892.

——. Note sur les Roches Éruptives de l'Ile de Jersey. 8vo. Brussels, 1892.

——. Traité de Géologie. 3e édition. 2e Partie. Fascicule 4. 1893. *Purchased.*

Leighton, Thomas. See *Blake, J. F.*

Lenk, H. *See* Felix, J.

Lenthérie, C. Le Rhône. Histoire d'un Fleuve. 2 vols. 8vo. Paris, 1891. *Purchased.*

Lesley, J. P. See Pennsylvania.

Digitized by Google

Lévy, Michel, et Munier-Chalmas. Mémoire sur les diverses formes affectées par le réseau élémentaire du Quartz. 8vo. Paris, 1892.

Liétard, —. See *Œhlert, D. P.*

Lobley, J. Logan. The Supply of Water to London in the near and distant future. 2nd edition. 8vo. London, 1892.

Locard, A. Les Coquilles Marines des Côtes de France. 8vo. Paris, 1892. *Purchased.*

Lossen, K. A. Gabbro mit Bänderung vom Bärenstein im Radauthal. 8vo. Berlin, 1891.

——. Ueber die fraglichen Tertiärablagerungen im Gebiet der Elbingeröder Mulde und ihre wahrscheinlichen Beziehungen zur Braunkohlenformation des nördlichen Harzrandes. 8vo. Wernigerode, 1891.

Lotti, B. *See* Italy.

Lugeon, —. See *Renevier, E.*

Lyman, B. S. Shippen and Wetherill Tract. 8vo. Philadelphia, 1893.

Macoun, J. *See* Canada.

Maitland, A. G. See Queensland.

Manchester Museum, Owens College. Museum Handbooks. Catalogue of Type Fossils. 8vo. Manchester, 1893. *Presented by the Curator.*

Mantell, G. Thoughts on a Pebble, or a First Lesson in Geology. Sixth edition. 8vo. London, 1842. *Purchased.*

Margerie, Emm. de, et Fr. Schrander. Aperçu de la Structure Géologique des Pyrénées. 8vo. Paris, 1892.

Marsh, O. C. Restoration of *Claosaurus* and *Ceratosaurus.* Restoration of *Mastodon americanus.* 8vo. New Haven, Conn., 1892.

——. A New Cretaceous Bird allied to *Hesperornis.* 8vo. New Haven, Conn., 1893.

——. Restoration of *Anchisaurus.* 8vo. New Haven, Conn., 1893.

——. Scientific Publications of, 1861–1892. [List of.] 8vo. New Haven, Conn., 1893.

——. The Skull and Brain of *Claosaurus.* 8vo. New Haven, Conn., 1893.

Meli, R. Resoconti della X^a^ Adunanza Generale Estiva tenuta dalla Società Geologica Italiana in Sicilia dal 2 al 12 Ottobre 1891. 8vo. Rome, 1892.

——. Sopra alcuni resti di Mammiferi Fossili nei Terreni Quaternari della Provincia di Roma. 8vo. Rome, 1892.

Digitized by Google

Mercalli, G. See *Ricco, A.*

Merrill, G. P. Handbook of the Department of Geology in the U.S. National Museum. Part 1. 8vo. Washington, 1892.

——. On some Basic Eruptive Rocks in the Vicinity of Lewiston and Auburn, Androscoggin Co., Maine. 8vo. Minneapolis, 1892.

——, *and R. L. Packard.* On an Azure-blue Pyroxenic Rock from the Middle Gila, New Mexico. 8vo. New Haven, Conn., 1892.

Meschinelli, A., et X. Squinabol. Flora Tertiaria Italica. 8vo. Padua, 1893. *Purchased.*

Meyer, A. B. Neue Beiträge zur Kenntniss des Nephrit und Jadeït. 4to. Berlin, 1891. *Purchased.*

Michigan. Geological Survey. Report of the State Board for the years 1891–92. 8vo. Lansing, 1893. *Presented by M. E. Wadsworth, Esq., F.G.S.*

Milch, L. Beiträge zur Kenntniss des Verrucano. Erster Theil. 8vo. Leipzig, 1892. *Purchased.*

Milne, John. Earthquakes and other Earth Movements. Third edition. 8vo. London, 1893. *Purchased.*

Milne, John, and W. K. Burton. The Volcanoes of Japan. Parts 1 and 2. Fujisan. Collotypes by K. Ogawa. Obl. 4to. Yokohama, &c., 1892.

Minnesota. Geological and Natural History Survey. (*N. H. Winchell,* State Geologist.) Annual Report for the year 1890. 8vo. Minneapolis, 1892.

——. ——. (——.) Annual Report for the year 1891. 8vo. Minneapolis, 1893.

——. ——. (——.) Bulletin No. 7. The Mammals of Minnesota. By C. L. Herrick. 8vo. Minneapolis, 1892.

Missouri. Geological Survey. (*Arthur Winslow,* State Geologist.) [Vol. i.] A Report on the Higginsville Sheet, Lafayette County, accompanied by a Geologic and Topographic Map and a Sheet of Sections. From Field Work prosecuted during the years 1890 and 1891 by Arthur Winslow. Fol. Jefferson City, 1892.

——. ——. (——.) Vol. ii. A Report on the Iron Ores of Missouri, from the Field Work prosecuted during the years 1891 and 1892. By F. L. Nason. 8vo. Jefferson City, 1892.

——. ——. (——.) Vol. iii. A Report on the Mineral Waters of Missouri, by P. Schweitzer and A. E. Woodward. 8vo. Jefferson City, 1892.

Digitized by Google

Missouri. Geological Survey. (*Arthur Winslow*, State Geologist.) Biennial Report of the State Geologist transmitted by the Bureau of Geology and Mines to the 37th General Assembly. 8vo. Jefferson City. 1893.

Mojsisovics, E. v. Die Hallstatter Entwicklungen der Trias. 8vo. Vienna, 1892.

——. Vorläufige Bemerkungen über die Cephalopoden Faunen der Himalaya-Trias. 8vo. Vienna, 1892.

Monckton, Horace W. The Bagshot Beds of the London Basin. 8vo. London, 1893.

——. Notes on the Denudation and Elevation of the Weald. 8vo. London, 1890.

——. On an Instance of Recent Erosion near Stirling. 8vo. London, 1890.

——. Notes on the Glacial Formation near Chelmsford. 8vo. Buckhurst Hill, 1891.

——. On the Gravels South of the Thames from Guildford to Newbury. 8vo. London, 1892.

——. The Bagshot Beds of Bagshot Heath. 8vo. London, 1892.

——, and J. G. Goodchild. The Geology of the Country round Stirling. 8vo. London, 1892.

——, and R. S. Herries. The Bagshot Beds of the London Basin. 8vo. London, 1892.

——, ——. On some Bagshot Pebble-Beds and Pebble Gravel. 8vo. London, 1889.

——, ——. On some Hill Gravels north of the Thames. 8vo. London, 1891.

Morton, G. H. The Geology and Mineral Veins of the Country around Shelve, Shropshire, with a notice of the Breidden Hills. 8vo. Liverpool, 1869.

——. The Progress of Geological Research in connection with the Geology of the Country around Liverpool. 8vo. Liverpool, 1871.

——. Remarks on the Introduction of Geological Maps. 8vo. Liverpool, 1876.

——. The Carboniferous Limestone and Cefn-y-Fedw Sandstone of the Country between Llanymynech and Minera, North Wales. 8vo. London, 1879.

——. List of Papers on the Geology of the Country around Liverpool from 1870 to June 1881, with some additions to the list published in 1871. 8vo. Liverpool, 1881.

Digitized by Google

Morton, G. H. The Carboniferous Limestone and Cefn-y-Fedw Sandstone of Flintshire. 8vo. Liverpool, 1886.

——. Notes on the Stanlow, Ince, and Frodsham Marshes. 8vo. Liverpool, 1888.

——. Further Notes on the Stanlow, Ince, and Frodsham Marshes. 8vo. Liverpool, 1889.

——. Some Faults exposed in Shafts and Borings in the Country around Liverpool. 8vo. Liverpool, 1889.

——. List of Works and Papers on the Geology of the Country around Liverpool from June 1881 to September 1890, with some additions to the former lists. 8vo. Liverpool, 1891.

——. The Geology of the Country around Liverpool, including the North of Flintshire, Second edition. 8vo. London, 1891.

Mouret, G. *See* France. *Ministère des Travaux Publics.*

Mrazec, L. See *Duparc, L.*

Munier-Chalmas. See *Lévy, Michel.*

Nason, F. L. *See* Missouri.

Nathorst, A. G. Om några mollusker och ostrakoder från quartära sotwattensaflagringar i Ryssland och Tyskland. 8vo. Stockholm, 1892.

——. Om några till riksmuseets växtpaleontologiska afdelning inkomna torfmossefynd. 8vo. Stockholm, 1892.

——. Sveriges Geologi. 1 Delen. 8vo. Stockholm, 1892.

——. Die Pflanzenreste eines Geschiebes von Zinow bei Neustrelitz. 8vo. Mecklenburg, 1893.

——. Jordens Historia, efter M. Neumayr's 'Erdgeschichte' utarbetad med sarskild hänsyn till Nordens Urverld. Häfte 9–11. 8vo. Stockholm, 1893.

Newfoundland. Geological Survey. Report for 1891 and 1892 on the Humber Valley and Central Carboniferous Area of the Island, by J. P. Howley, F.G.S. 8vo. St. John's, N.F., 1893. *Presented by the Secretary of State for the Colonies.*

New South Wales. Department of Mines. Annual Report of the Department of Mines and Agriculture, New South Wales, for the year 1891. 4to. Sydney, 1892. *Presented by the Agent-General for New South Wales.*

Digitized by Google

New South Wales. Legislative Assembly. Annual Statement of Works carried out by the Public Works Department during the year 1891. 4to. Sydney, 1892. *Presented by the Agent-General for New South Wales.*

——. ——. Harbours and Rivers. Report on Dredging Operations by the Engineer-in-Chief. C. W. Darley. 4to. Sydney, 1891.

Newton, E. T. *See* Gunn, J.

Newton, R. Bullen. Catalogue of Fossils presented to the School Board for London by the Trustees of the British Museum. 8vo. London, 1893.

New York. *Geological Survey.* Palæontology. Vol. viii. Part 1. By *J. Hall* and J. M. Clarke. 4to. Albany, N.Y., 1892.

——. ——. Eighth Annual Report of the State Geologist (*James Hall*) for the year 1888. 8vo. Albany, 1889.

New Zealand. *Colonial Museum and Geological Survey.* Reports of Geological Explorations during 1890–91. 8vo. Wellington, N.Z., 1891.

——. ——. Twenty-sixth Annual Report on the Colonial Museum and Laboratory. 8vo. Wellington, N.Z., 1891.

——. *Department of Mines.* Reports on the Mining Industry of New Zealand. 4to. Wellington, 1892.

Nikitin, S. *See* Russia.

Noë, G. de la, et Emm. de Margerie. Les Formes du Terrain. Text and Plates. 4to. Paris, 1888. *Presented by Horace B. Woodward, Esq., F.G.S.*

Norway. *Norges Geologiske Undersögelse.* Det nordlige Norges geologi. Med bidrag af Tellef Dahll og O. A. Corneliussen, udgivet af Hans Reusch. 8vo. Christiania, 1892.

——. ——. Om dannelse af jernmalmforekomster. Af J. H. L. Vogt. 8vo. Christiania, 1892.

——. ——. Nikkelforekomster og nikkelproduktion. Af J. H. L. Vogt. 8vo. Christiania, 1892.

——. ——. Torvmyrer inden Kartbladet 'Sarpsborgs' Omraade. Af G. E. Stangeland. 8vo. Christiania, 1892.

——. ——. No. 8. Torvmyrer inden Kartbladet 'Nannestads' Omraade. Af G. E. Stangeland. 8vo. Christiania, 1892.

——. ——. No. 9. Jordbunden i Norge. Af Amund Helland. 8vo. Christiania, 1893.

Digitized by Google

Nova Scotia. Reports of the Chief Commissioner of Mines for the Province of Nova Scotia for the years 1867, 1868, 1880, 1891, and 1892. 8vo. Halifax, N.S., 1868, 1869, 1881, 1892, and 1893. *Presented by Edward Gilpin, Jr., A.M., F.G.S., Inspector of Crown Mines, Nova Scotia.*

Œhlert, D. P. Sur le Genre *Spyridiocrinus*. 8vo. Paris, 1890.

——. Description de deux Crinoïdes nouveaux du Dévonien de la Manche. 8vo. Paris, 1891.

——. Sur le Silurien Inférieur dans les Coëvrons. 8vo. Paris, 1891.

——. Brachiopodes. 1890. [Extrait de l'Annuaire Géologique Universel.] 8vo. Paris, 1892.

——, et *Liétard*. Note sur les Calcaires des Environs d'Eaux-Bonnes (Basses-Pyrénées). 8vo. Paris, 1891.

Ogilvie, Maria M. Contributions to the Geology of the Wengen and St. Cassian Strata in Southern Tyrol. 8vo. London, 1893.

Omboni, G. Achille de Zigno [Obituary Notice]. 8vo. Padua, 1892.

Packard, R. L. See *Merrill, G. P.*

Paléontologie Française. Terrains Tertiaires. Éocène, Échinides. Tome ii. Livraisons 26 and 27, par G. Cotteau. 8vo. Paris, 1892. *Purchased.*

Parent, H. Étude sur la Craie à *Micraster* du Boulonnais et sur les Plissements de la Craie dans cette région. 8vo. Lille, 1892.

——. Le Wealden du Bas-Boulonnais. 8vo. Lille, 1893.

Parks, J. V. *See* South Australia.

Penning, W. H. The Geology of the Southern Transvaal. 8vo. London, 1893. With Geological Map $\frac{1}{1,000,000}$.

Pennsylvania. *Geological Survey*. Final Report. A summary description of the Geology of Pennsylvania, by *J. P. Lesley*. Vols. i. and ii. 8vo. Harrisburg, 1892.

——. ——. AA. Atlas. Southern Anthracite Field. Part iv. B. 8vo. Harrisburg, 1891.

——. ——. AA. Atlas. Southern Anthracite Field. Part v. 8vo. Harrisburg, 1891.

——. ——. ——. ——. ——. Part vi. 8vo. Harrisburg, 1891.

Péron, A. See *Cotteau, G.*

Philippi, R. A. Tertiärversteinerungen aus der Argentinischen Republik. 4to. Leipzig, 1893. *Purchased.*

Digitized by Google

Pomel, A. Carte Géologique de l'Algérie $\frac{1}{800,000}$. Explication de la deuxième édition, par A. Pomel. 4to. Algiers, 1890. (With Map.) *Purchased.*

Pompeckj, J. F. Beiträge zu einer Revision der Ammoniten des Schwäbischen Jura. Lieferung 1. 8vo. Stuttgart, 1893. *Purchased.*

Portugal. *Commissão dos Trabalhos Geologicos de Portugal.* Communicações. Tom. ii. Fasc. 2. 8vo. Lisbon, 1892.

——. ——. Description de la Faune Jurassique du Portugal. Mollusques Lamellibranches, par Paul Choffat. Premier ordre, *Siphonida.* Livraison 1. 4to. Lisbonne, 1893.

Posewitz, T. Borneo: its Geology and Mineral Resources. Translated by *F. H. Hatch.* 8vo. London, 1892.

Powell, J. W. *See* United States.

Preller, C. S. Du Riche. Note on a Coast-Section at the Lizard. 8vo. London, 1893.

——. Note on the Lakes of Zürich and Wallen. 8vo. London, 1893.

——. Note on the Tuscan Archipelago. 8vo. London, 1893.

——. The Future of British Engineering. 8vo. London, 1893.

Queensland. Queensland Museum. Annual Report of the Trustees, 1892. 4to. Brisbane, 1892.

——. Geological Survey. Annual Progress Report of the Geological Survey for the year 1890. (*R. L. Jack*, Government Geologist.) 4to. Brisbane, 1891.

——. ——. Geological Observations in British New Guinea in 1891, by A. Gibb Maitland. 4to. Brisbane, 1892. *Presented by Robert L. Jack, Esq., F.G.S., Government Geologist.*

——. ——. Report on a New Discovery of Coal near the Callide Creek, Port Curtis District, by *W. H. Rands.* 4to. Brisbane, 1891.

——. ——. Report by *A. Gibb Maitland* on the Physical Geology of Magnetic Island. 4to. Brisbane, 1892.

——. ——. Mount Morgan Gold Deposits. Third Report on the, by *Robert L. Jack*, Government Geologist. 4to. Brisbane, 1892.

——. ——. Report on the Styx River Coal Field, by *W. H. Rands.* 4to. Brisbane, 1892.

——. ——. Report on the Alluvial Cinnabar Deposit near Kilkivan, by *W. H. Rands.* 4to. Brisbane, 1892.

Digitized by Google

Queensland. Geological Survey. Second Report on the Normanby Gold Field, by *Robert L. Jack*, Government Geologist. 4to. Brisbane, 1893.

——. ——. Report on the Russel River Gold Field, by *Robert L. Jack*, Government Geologist. 4to. Brisbane, 1893.

Quiroga, F. Anomalias ópticas de la blende en Picos de Europa. 8vo. Madrid, 1892.

——. Observaciones al mapa geológico del Sahara, de M. Rolland. 8vo. Madrid, 1892.

Rands, W. H. *See* Queensland.

Rath, Gerhard vom. Sach- und Orts-Verzeichniss zu den mineralogischen und geologischen Arbeiten von. Im Auftrage der *Frau vom Rath* von W. Bruhns und K. Busz. 8vo. Leipzig, 1893.

Reade, T. Mellard. An Outline of Mr. Mellard Reade's Theory of the Origin of Mountain-Ranges by Sedimentary Loading and Cumulative Recurrent Expansion: in Answer to Recent Criticisms. 8vo. London, 1891.

——. Stalagmites of Sand. 8vo. 1891.

——. The Cause of active compressive Stress in Rocks and recent Rock-flexures. 8vo. New York, 1891.

——. The Effect of Sedimentation on the Temperature of the Earth's Crust. 8vo. London, 1891.

——. The Perched Blocks of Norber Brow and their Levels relative to their Place of Origin. 8vo. London, 1891.

——. Faulting in Drift. 8vo. London, 1892.

——. Glacial Geology. 8vo. London, 1892.

——. The Rounding of Sandstone Grains of the Trias as bearing on the Divisions of the Bunter; also, The Trias of Cannock Chase. 8vo. Liverpool, 1892.

——. Eskdale Drift and its bearing on Glacial Geology.—Glacial Geology; Old and New. 8vo. London, 1893.

——. Measurement of Geological Time. 8vo. London, 1893.

Reid, Clement. On the Natural History of Isolated Ponds. 8vo. Norwich, 1892.

Reiss, W., und A. Stubel. Reisen in Süd-Amerika. Geologische Studien in der Republik Colombia. I. Petrographie. 1. Die Vulkanischen Gesteine, bearbeitet von R. Kuch. 4to. Berlin, 1892. *Purchased.*

Digitized by Google

Reiss, W., und A. Stubel. Geologische Studien in der Republik Ecuador. I. Petrographische Untersuchungen. 1. West-Cordillere. Lieferung 1. Tulcan bis Escaleras-Berge, bearbeitet von Max Belowsky. 4to. Berlin, 1892. *Purchased.*

Renevier, E. Bélemnites Aptiennes. 8vo. Lausanne, 1893.

——. Commission Internationale de la Carte Géologique d'Europe. Procès-Verbal des Séances tenues les 27 et 28 Septembre, 1892, dans la Salle du Sénat de l' Université de Lausanne. 8vo. Lausanne, 1893.

——, et — Lugeon. Géologie du Chablais et Faucigny-Nord. 8vo. Lausanne, 1893.

Reunert, —. Diamond Mines of South Africa. 8vo. London, 1892. *Purchased.*

Reusch, H. *See* Norway.

Reyer, E. Geologische und geographische Experimente. I. Heft. Deformation und Gebirgsbildung. 8vo. Leipzig, 1892.

——. ——. II. Heft. Vulkanische und Massen-Eruptionen. 8vo. Leipzig, 1892.

Rhind, W. The Age of the Earth considered Geologically and Historically. 8vo. Edinburgh, 1838. *Purchased.*

Ricco, A. Der gegenwärtige Ausbruch des Aetna. 8vo. Berlin, 1892.

——. Éruption de l'Etna de 1892. 8vo. Paris, 1892.

——. Fumo di Vulcano veduto dall' Osservatorio di Palermo durante l'Eruzione del 1889 ed applicazione della Termodinamica alle Eruzioni Vulcaniche. 4to. Rome, 1892.

——. L'Eruzione dell' Etna. 8vo. Rome, 1892.

——, G. Mercalli e S. Arcidiacono. Sopra il periodo eruttivo dello Stromboli cominciato il 24 Giugno 1891. 4to. Rome, 1892.

Richards, Sir G. H. Report on the present state of the Navigation of the River Mersey (1892). 8vo. London, 1893.

Roberts, Thomas. The Jurassic Recks of the neighbourhood of Cambridge. Being the Sedgwick Prize Essay for 1886. 8vo. Cambridge, 1892. *Presented by the Syndics of the Cambridge University Press.*

Röhrig, E. Technologisches Wörterbuch. Deutsch-Englisch-Französisch. Band I. 8vo. Wiesbaden, 1887. *Purchased.*

Rosenbusch, H. Mikroskopische Physiographie der Mineralien und Gesteine. Band 1. 3e Auflage. 8vo. Stuttgart, 1892.

Digitized by Google

Royal Commission on Metropolitan Water Supply. County Council of Hertfordshire. Hertfordshire Rainfall, Percolation, and Evaporation. Statement of *John Hopkinson, F.G.S.* 4to. London, 1892.

Russell, R. *See* Great Britain.

Russia. *Comité Géologique.* Bulletins. 1890. Tome ix. Nos. 9–10. 1891.

——. ——. ——. 1891. Tome x. Nos. 1–9. 1891.

——. ——. ——. ——. Tome x. Supplément. Bibliothèque Géologique de la Russie. 1890. Composée sous la rédaction de S. Nikitin. 8vo. St. Petersburg, 1891.

——. ——. ——. 1892. Tome xi. Nos. 1–3. 1892.

——. ——. Mémoires. Vol. xi. No. 2. Carte Géologique Générale de la Russie. Feuille 126. Perm-Solikamsk. Notes Explicatives à la Carte Géologique par A. Krasnopolsky. 4to. St. Petersburg, 1891.

——. ——. ——. Vol. xiii. No. 1. 1892. Geologische Untersuchungen im Nikolai-Pawdinschen Kreise und Umgebung im Gebiete des Central-Ural und dessen östlichen Abhange von A. Saitzew. 4to. St. Petersburg, 1892.

Rust, D. *See* Canada.

Rütimeyer, L. Die eocänen Säugethiere von Egerkingen. 8vo. Basel, 1892.

Sabatini, V. *See* Italy.

Saitzew, A. *See* Russia.

Salter, J. W. *See* Great Britain.

Sandberger, F. v. Die Lagerung der Muschelkalk- und Lettenkohlen-Gruppe in Unterfranken. 8vo. Würzburg, 1892.

——. Geologische Skizze der Umgebung von Würzburg. 8vo. Würzburg, 1892.

——. Ueber die pleistocänen Kalktuffe der fränkischen Alb, nebst Vergleichungen mit analogen Ablagerungen. 8vo. Munich, 1893.

São Paulo (Brazil). *Commissão Geographica e Geologica do Estado de São Paulo.* Boletim. Nos. 4–7. 8vo. São Paulo, 1890.

Sawyer, A. R. Mining, Geological, and General Guide to the Murchison Range. 8vo. London, 1892.

Schrander, Fr. See *Margerie, Emm. de.*

Schweitzer, P. *See* Missouri.

Scotland. Geological Survey. *See* Great Britain and Ireland.

Digitized by Google

Seebach, Karl von. Ueber Vulkane Centralamerikas. 4to. Göttingen, 1892.

Seeley, H. G. Researches on the Structure, Organization, and Classification of the Fossil Reptilia. VII. Further Observations on *Pareiasaurus*. 4to. London, 1892.

Seward, A. C. Fossil Plants as Tests of Climate, being the Sedgwick Prize Essay for the year 1892. 8vo. London, 1892.

Shaler, N. S. Aspects of the Earth. 8vo. London, 1890. *Purchased.*

Shumard, G. G. A Partial Report on the Geology of Western Texas. 8vo. Austin, 1886.

——. *See* Texas.

Sieger, R. Schwankungen der innerafrikanischen Seen. 8vo. Vienna, 1887.

——. Die Schwankungen der hocharmenischen Seen seit 1800 in Vergleichung mit einigen verwandten Erscheinungen. 8vo. Vienna, 1888.

——. Klimaschwankungen. 8vo. Vienna, 1891.

——. Das gegenwärtige Sinken grosser afrikanischen Seen. 4to. Brunswick, 1893.

——. Postglaciale Uferlinien des Bodensees. 8vo. Lindau i. B., 1893.

Simony, F. Das Dachsteingebiet. Lieferung 2. 4to. Vienna, 1893. *Purchased.*

Simpson, M. The Fossils of the Yorkshire Lias: Described from Nature. 8vo. London, 1855. *Presented by Horace W. Monckton, Esq., F.L.S., F.G.S.*

Sitenský, F. *See* Bohemia.

Solier, F. *See* Albarellos, N.

South Australia. Further Geological Examination of Leigh's Creek and Hergott Districts, also Report upon a Shale Deposit in the Encounter Bay District, by the *Government Geologist*. Also Papers on South Australian Lower Silurian and Mesozoic Fossils, by R. Etheridge, Jun. 4to. Adelaide, 1892.

——. Report on Country in the neighbourhood of Lake Eyre, by *H. Y. L. Brown*, Government Geologist. 4to. Adelaide, 1892.

——. Report on Northern Territory Mines and Mineral Resources, by *J. V. Parkes*. 4to. Adelaide, 1892.

South Kensington Museum. Department of Science and Art. See *Blake, J. F.* (Catalogue of the Percy Collection.)

Digitized by Google

Sowerby, James. The Mineral Conchology of Great Britain. Vols. i.–vii. (as published). 8vo. London, 1812–46. *Purchased.* (Library copy.)

Spain. *Comision del Mapa Geológico de España.* Boletin. Tomo xviii. 1892.

Squinabol, X. *See* Meschinelli, A.

Stainton, H. T. *See* Buckler, W.

Stangeland, G. E. *See* Norway.

Stapff, F.M. Ueber die Zunahme der Dichtigkeit der Erde nach ihrem Inneren. 8vo. Berlin, 1892.

——. Eine zerbrochene Fensterscheibe. 8vo. Essen, 1893.

——. Taraspit. Ein neuer Ornamentstein. 8vo. Berlin, 1893.

Stefanescu, G. On the existence of the *Dinotherium* in Roumania. 8vo. Rochester, U.S.A., 1891.

Stirling, J. *See* Victoria.

Strangways, C. Fox-. *See* Great Britain.

Struckmann, C. Ueber die bisher in der Provinz Hannover und den unmittelbar angrenzenden Gebieten aufgefundenen fossilen und subfossilen Reste quartärer Säugethiere. 8vo. Hannover, 1892.

Stubel, A. *See* Reiss, W.

Tarr, R. S. *See* Texas.

Tate, Ralph. The Gastropods of the Older Tertiary of Australia. Parts 2 & 3 and Plates. 8vo. Adelaide, 1889–91.

——. A Bibliography and Revised List of the Described Echinoids of the Australian Eocene, with Descriptions of some new Species. 8vo. Adelaide, 1891.

Tate, T. The Yorkshire Boulder Committee and its Sixth Year's Work. 8vo. Birmingham, 1893.

Texas. *Geological Survey.* (E. T. Dumble, State Geologist.) Second and Third Annual Reports, 1890 and 1891. 8vo. Austin, 1891 and 1892.

——. ——. (——.) Second Report of Progress. 1891. 8vo. Austin, 1892.

——. ——. (——.) Bulletin. No. 1. Artesian Water on the Llano Estacado, by G. G. Shumard and G. H. Kalteyer. 8vo. Austin, 1892.

——. ——. (——.) ——. No. 2. A Preliminary Report on the Soils and Waters of the Upper Rio Grande and Pecos Valleys in Texas, by H. Harrington. 8vo. Austin, 1860.

Digitized by Google

Texas. *Geological Survey.* (E. T. Dumble, State Geologist.) Bulletin. No. 3. Reconnoissance of the Guadalupe Mountains, by R. S. Tarr. 8vo. Austin, 1892.

——. ——. (——.) ——. No. 4. A Preliminary annotated Check List of the Cretaceous Invertebrate Fossils of Texas, by R. T. Hill. 8vo. Austin, 1889.

——. See *Shumard, G. G.*

Theobald, W. *See* India.

Topley, W. The Sandgate Landslip. 8vo. London, 1893. [Geol. Assoc.]

——. ——. ——. [R. Geogr. Soc.]

Tornquist, A. Der Gypskeuper in der Umgebung von Göttingen. 8vo. Göttingen, 1892.

Toula, Franz. Reisebilder aus Bulgarien. 12mo. Vienna, 1892.

——. Ueber Wildbach-Verheerungen und die Mittel, ihnen vorzubeugen. 8vo. Vienna, 1892.

——. Zwei neue Säugethierfundorte auf der Balkanhalbinsel. 8vo. Vienna, 1892.

Traverso, Stefano. Forme Lenticolari dell' Argilla in Bognanco (Ossola). 8vo. Genoa, 1893.

——. Quarziti e Schisti Metamorfici del Sarrabus (Sardegna). 8vo. Genoa, 1893.

Unger, F., und T. Kotschy. Die Insel Cypern ihrer physischen und organischen Natur nach, mit Rücksicht auf ihre frühere Geschichte. 8vo. Vienna, 1865. *Purchased.*

United Kingdom. Geological Survey. Memoirs. *See* Great Britain and Ireland.

United States. *Department of the Interior. Geographical and Geological Survey of the Rocky Mountain Region.* J. W. Powell in charge. Contributions to North-American Ethnology. Vol. VII. 4to. Washington, 1890.

——. ——. *United States Geological Survey.* Mineral Resources of the United States, 1889 and 1890, by David T. Day. 8vo. Washington, 1892.

Ussher, W. A. E. The British Culm Measures. 8vo. Taunton, 1892.

Victoria. *Department of Mines.* Annual Report of the Secretary for Mines to the Minister of Mines for Victoria for the year 1891. 4to. Melbourne, 1892.

Digitized by Google

Victoria. *Department of Mines.* Special Reports. Notes on the Glacial Conglomerate, Wild Duck Creek, by E. J. Dunn. 4to. Melbourne, 1892.

——. ——. ——. Reports on the Victorian Coal-fields, by James Stirling. 4to. Melbourne, 1892.

——. ——. ——. Report on the Bendigo Gold-field, by E. J. Dunn. 4to. Melbourne, 1893.

——. ——. ——. ——. ——. *Presented by E. J. Dunn, Esq., F.G.S.*

Vieillard, E. F. Le Terrain Houiller de Basse-Normandie, ses Ressources, son Avenir. 8vo. Caen, 1874. *Purchased.*

Vinot, Léon. Étude sur les Tremblements de Terre. 8vo. Paris, 1893. *Purchased.*

Vogt, J. H. L. *See* Norway.

Walker, J. Francis. On Liassic Sections near Bridport, Dorsetshire. 8vo. London, 1892.

——. On the Brachiopoda recently discovered in the Yorkshire Oolites. 8vo. York, 1893.

Walther, J. Bionomie des Meeres. Erster Theil einer Einleitung in die Geologie als historische Wissenschaft. 8vo. Jena, 1893. *Purchased.*

Ward, J. C. *See* Great Britain.

Wardle, Thomas. The Entomology and Uses of Silk. 8vo. Newcastle-under-Lyme, 1892.

Warren, Erasmus. Geologia, or a Discourse concerning the Earth before the Deluge. 4to. London, 1690. *Presented by Clement Reid, Esq., F.L.S., F.G.S.*

Weisbach, A. Tabellen zur Bestimmung der Mineralien mittels äusserer Kennzeichen. 8vo. Leipzig, 1892. *Purchased.*

Western Australia. Annual General Report for 1888–1889, by Harry Page Woodward. 4to. Perth, 1890. *Presented by the Secretary of State for the Colonies.*

Whitaker, W. Borough of King's Lynn. Report on the best Source of Water Supply for the Town. 8vo. King's Lynn, 1892.

——, *and A. H. Green.* London County Council. London Water Supply Enquiry. Preliminary Report on the Possibility of obtaining a Supply of Water for London within the Thames Basin. 8vo. London, 1891.

Digitized by Google

Whiteaves, J. F. *See* Canada.

Wilde, Henry. On the Origin of Elementary Substances and on some new Relations of their Atomic Weights. 8vo. London, 1892.

Williams, G. H. Anatase from the Arvon Slate Quarries, Buckingham Co., Va. 8vo. New Haven, Conn., 1891.

——. Notes on some Eruptive Rocks from Alaska. 8vo. Baltimore?, 1891.

——. The Volcanic Rocks of South Mountain in Pennsylvania and Maryland. 8vo. New Haven, Conn., 1892.

Williamson, W. C. General, Morphological, and Histological Index to the Author's Collective Memoirs on the Fossil Plants of the Coal Measures. Parts I. and II. 8vo. Manchester, 1891, 1893.

Wilson, E. See *Hudleston, W. H.*, and *Winwood, H. H.*

Winchell, N. H. See Minnesota.

Winslow, A. See Missouri.

Winwood, H. H. On some Deep-Well Borings in Somerset and elsewhere. 8vo. Bath, 1893.

——, and E. Wilson. Charles Moore, F.G.S., and his Work, with a List of the Fossil Types and Described Specimens in the Bath Museum. 8vo. Bath, 1892.

Wolf, Teodoro. Geografia y Geologia del Ecuador. 8vo. Leipzig, 1892. *Purchased.*

Wolff, R. *See* Albarellos, N.

Woods, H. Additions to the Type Fossils in the Woodwardian Museum. 8vo. London, 1893.

Woodward, A. E. *See* Missouri.

Woodward, B. B. On the Mode of Growth and the Structure of the Shell in *Velates conoideus*, Lamk., and other Neritidæ. 8vo. London, 1892.

Woodward, Harry P. *See* Western Australia.

Woodward, Henry. Sir Richard Owen, K.C.B. [Obituary Notice.] 8vo. London, 1893.

——. See *Jones, T. Rupert.*

Woodward, Horace B. The Geology of Swanage. 8vo. Swanage, 1892.

——. *See* Gunn, J.

Digitized by Google

Wundt, T. Die Besteigung des Cimone della Pala. Obl. 4to. Stuttgart, 1892. *Purchased.*

Zeiller, R. Sur les empreintes du sondage de Douvres. 4to. Paris, 1892.

——. *See* France. *Ministère des Travaux Publics.*

Zirkel, F. Lehrbuch der Petrographie. 2e Auflage. Band 1. 8vo. Leipzig, 1893. *Purchased.*

---

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Names of Donors in Italics.

Algiers. Ministère des Travaux Publics. Gouvernement Général de l'Algérie. Carte Géologique provisoire de l'Algérie $\frac{1}{800,000}$. *Purchased.*

Bohemia. *See* Books. Bohemia. *Landesdurchforschungs Comité.* Archiv. Band vii. No. 4. 1891.

De Rance, C. E. Map of River Basins. England and Wales in County Council Groups. Scale about 16 miles to an inch. Manchester, 1893.

Finland. Geologiska Undersökning. Kartbladet Nos. 18–21. Scale $\frac{1}{200,000}$.

France. *Dépôt de la Marine.* 19 Charts and Plans of various Coasts and Ports.

——. Ministère des Travaux Publics. Carte Géologique de la France à l'échelle du millionième. *Purchased.*

Geikie, Sir Archibald. Geological Map of Scotland, with Descriptive Text. Scale 10 miles to an inch. 8vo. Edinburgh, 1892. *Purchased.*

Great Britain and Ireland. Geological Survey. England and Wales. 1-inch Maps. (Solid.) Sheets 80 S.E.; 86; 96 N.W., S.W.; 97 N.E., S.W.; 106 S.W.; 107 S.E.; 108 N.E., S.W.

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——. ——. Ireland. 1-inch Maps. Sheets 1, 2, 4, 5, 9–11, 15, 16, 20, 22, 24, 30–32, 99–102, 105, 109, 110–112, 114, 115, 117–125, 127–150, 152–157, 159–171, 173–201, 203–205.

——. ——. ——. Horizontal Sections. Sheets 2, 3, 4, 5, 29, 30, 31, 32, 33, 34, 36, 37.

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——. *Ordnance Survey.*

One-inch General Maps. England and Wales. New Series. 21 Quarter-sheets.

——. Scotland. 7 Sheets.

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——. Indexes, 16.

Penning, W. H. Stanford's Map of the Transvaal Goldfields, with the Geology of the Southern part of the Transvaal. Scale $\frac{1}{1,000,000}$. 1893.

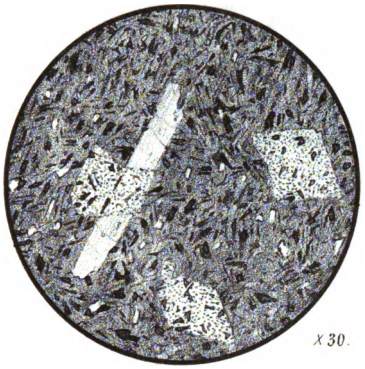
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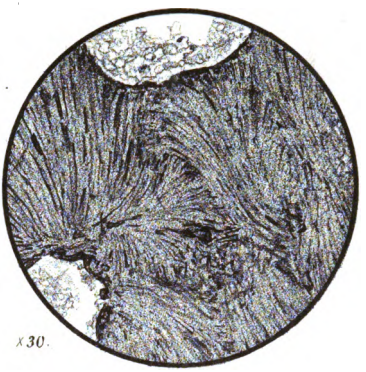
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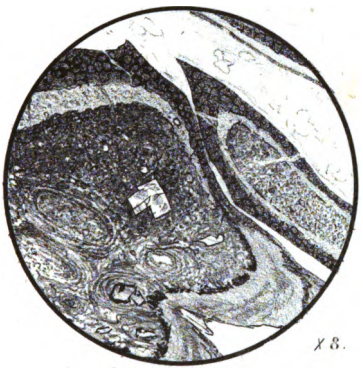
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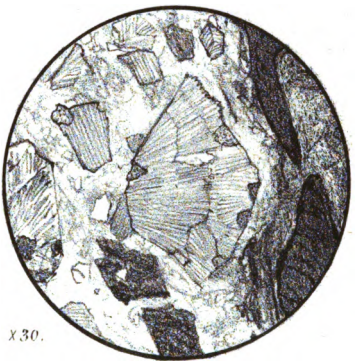
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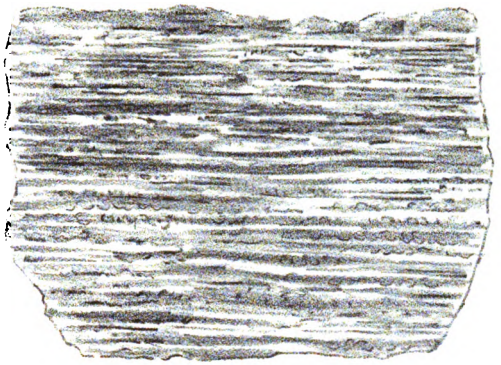


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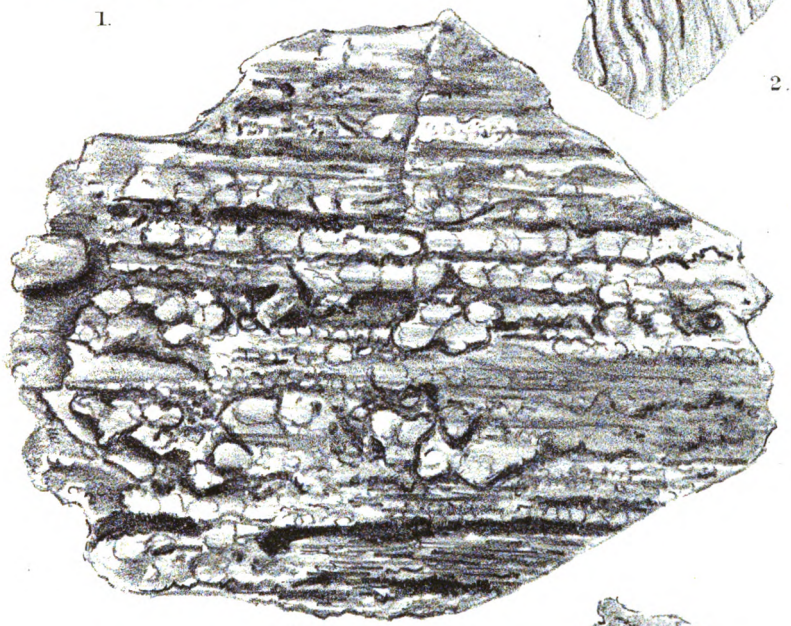
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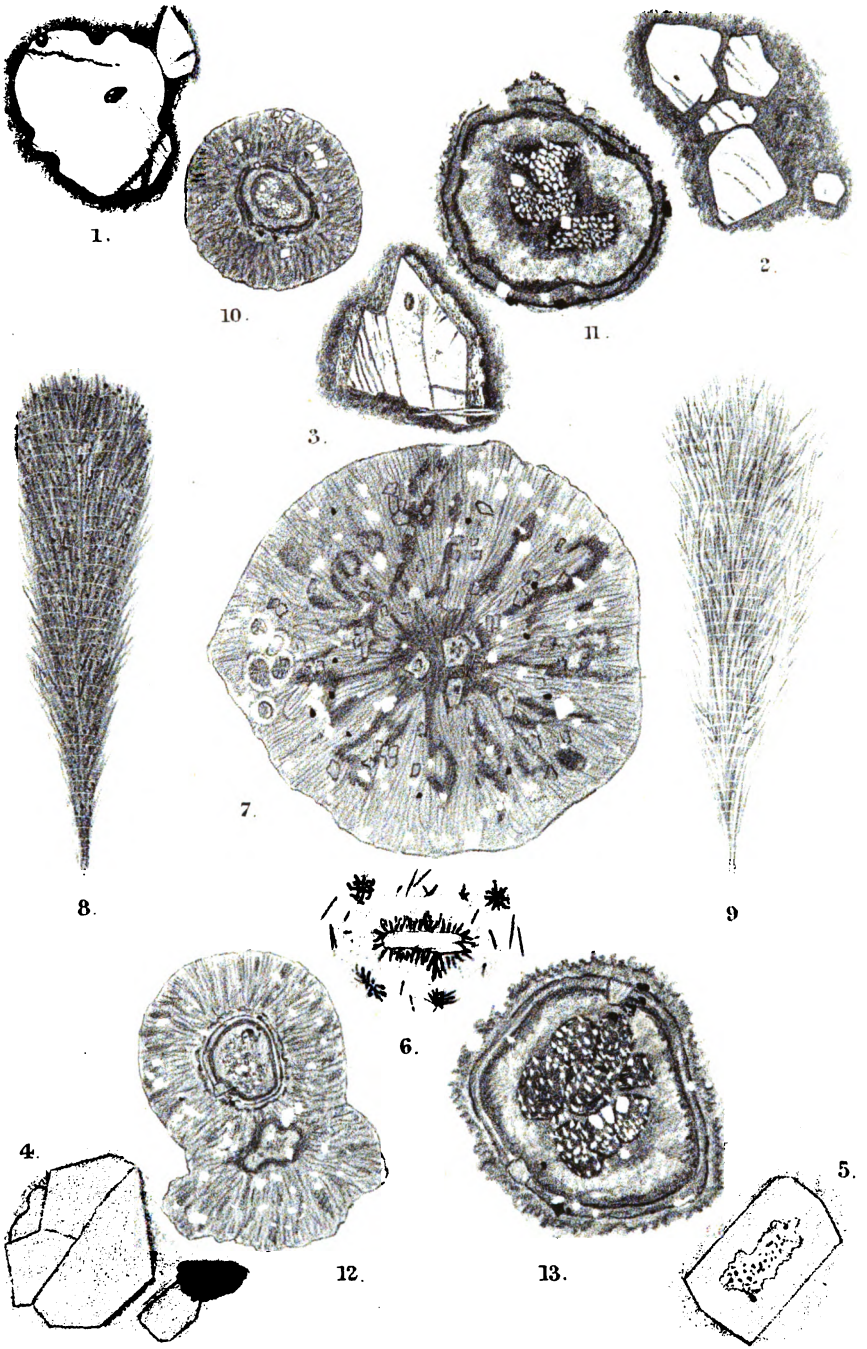
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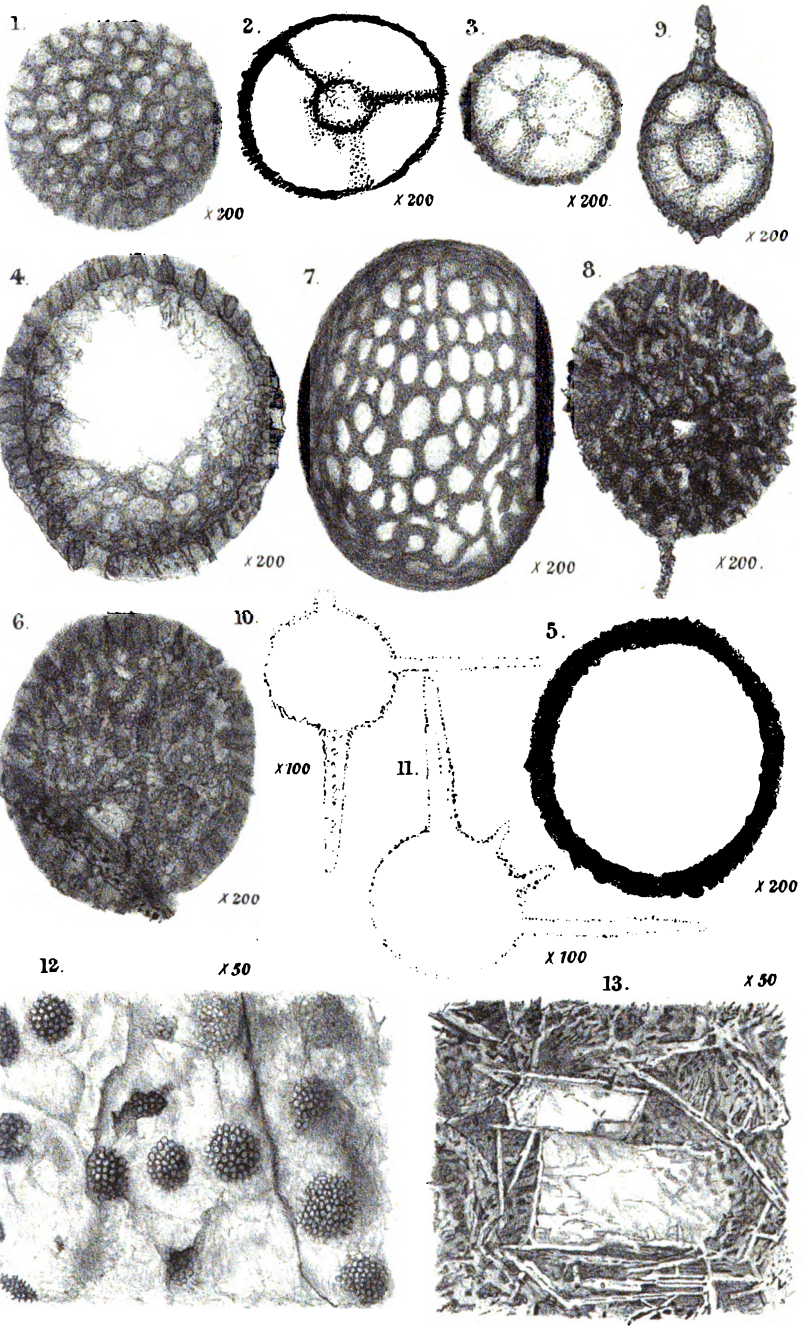


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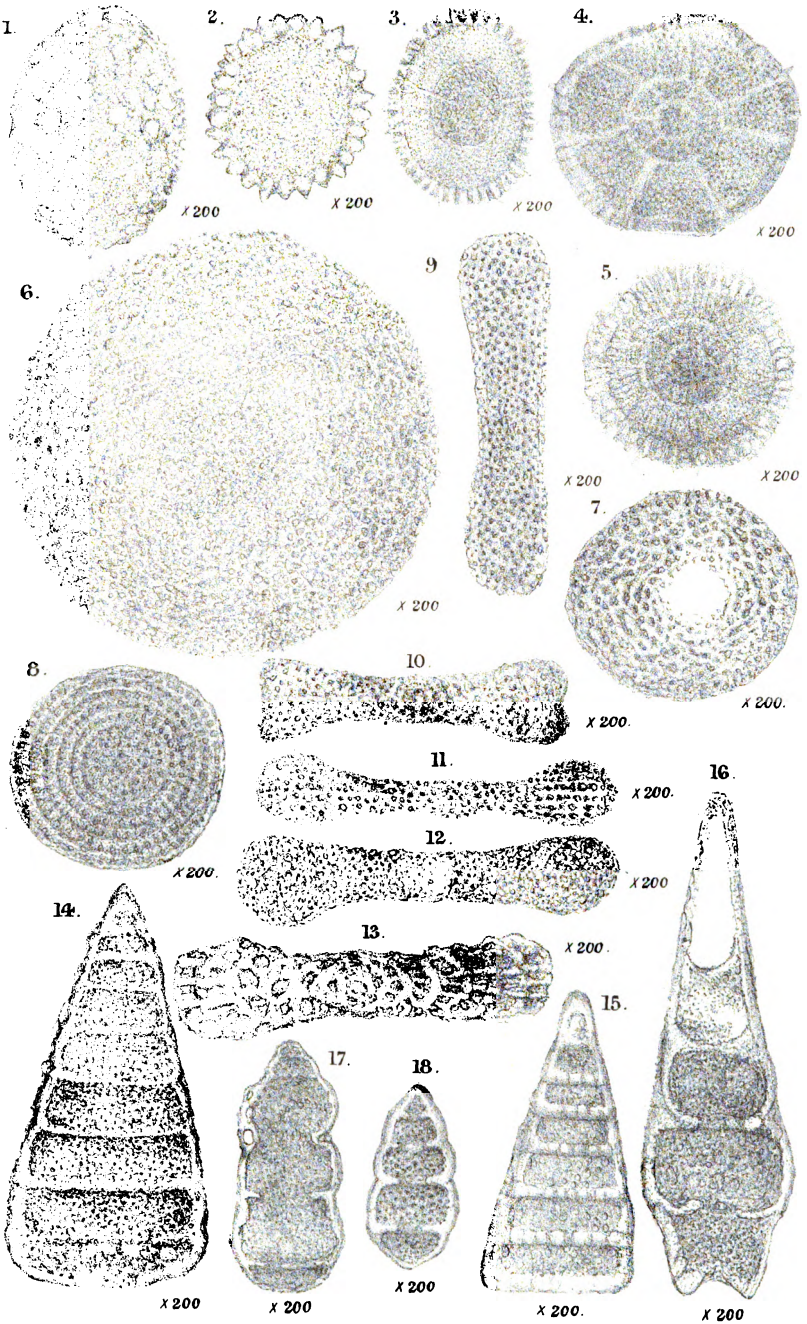


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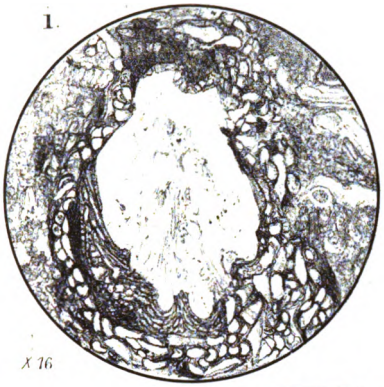


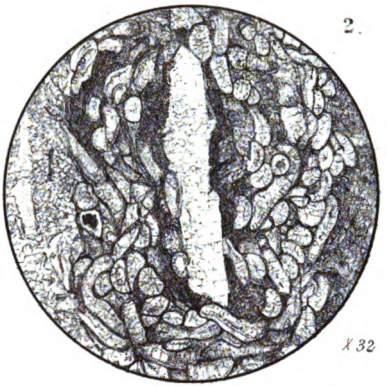
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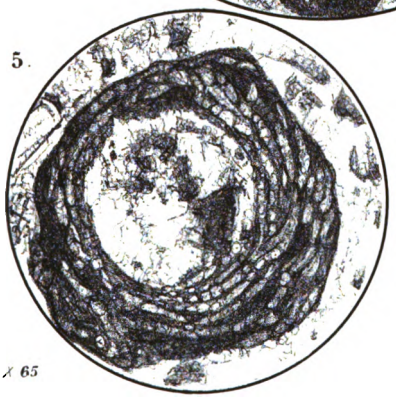


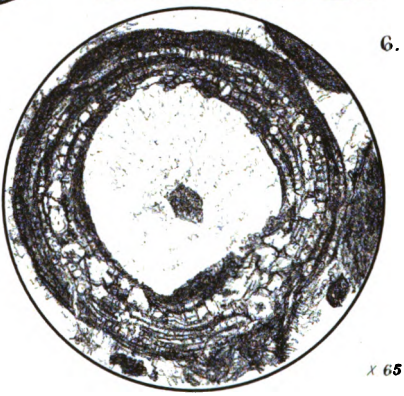










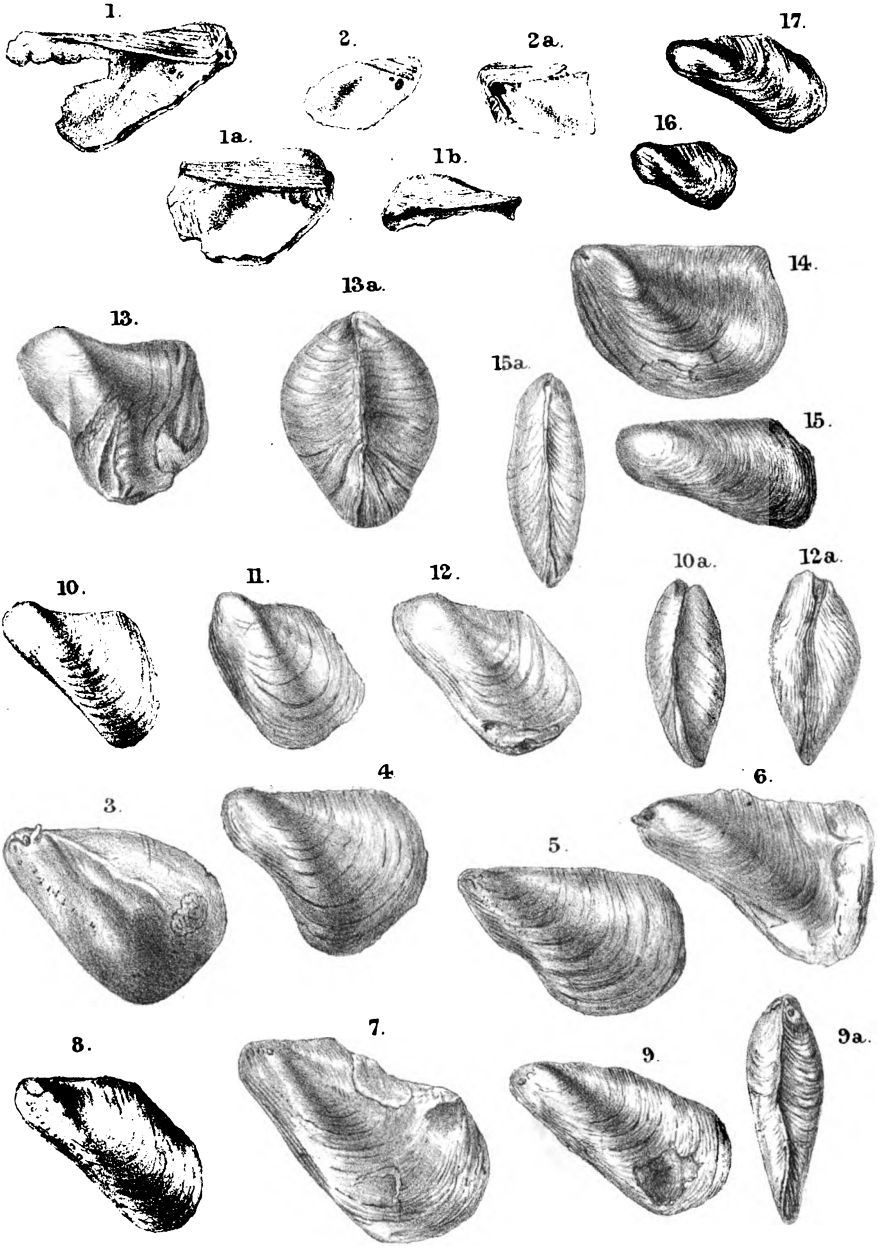


F. H. Michael del. et lith. Mintern Bros. imp.

GIRVANELLA IN WENLOCK LIMESTONE.

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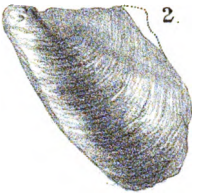
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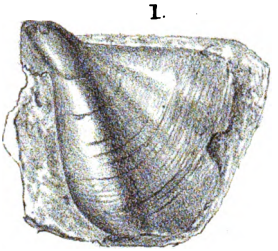
BRITISH COAL-MEASURE MOLLUSCA.

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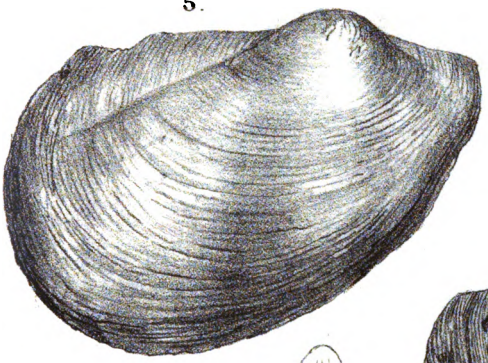


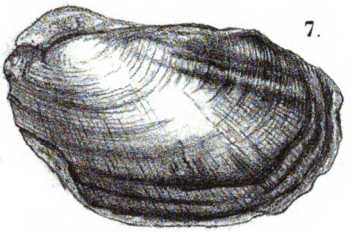


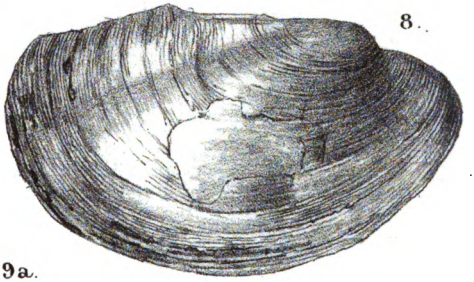








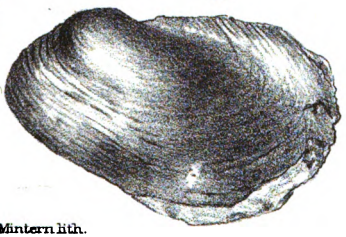


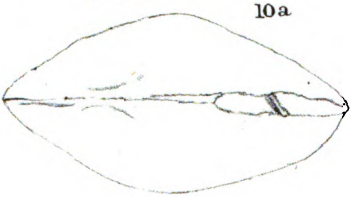










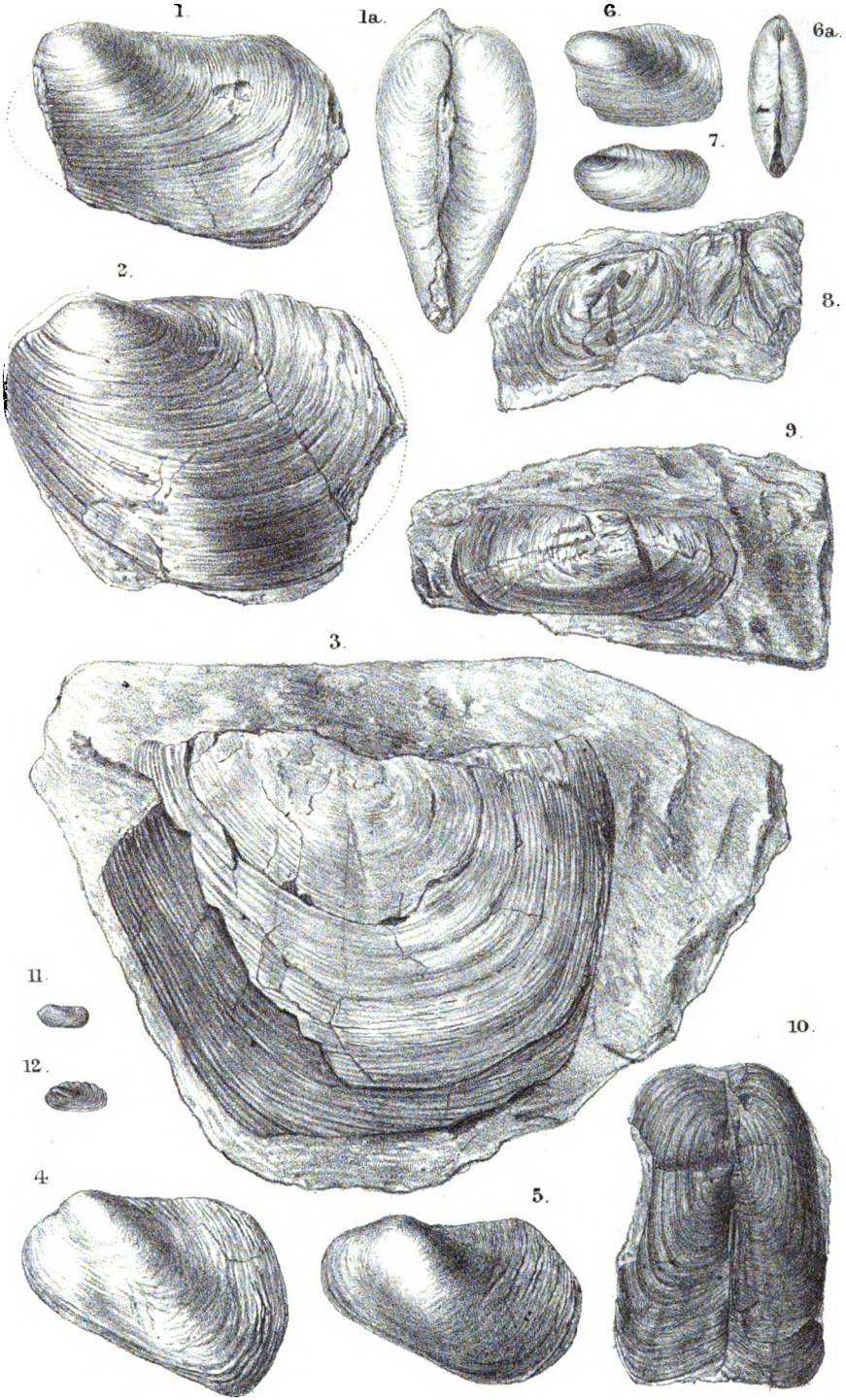


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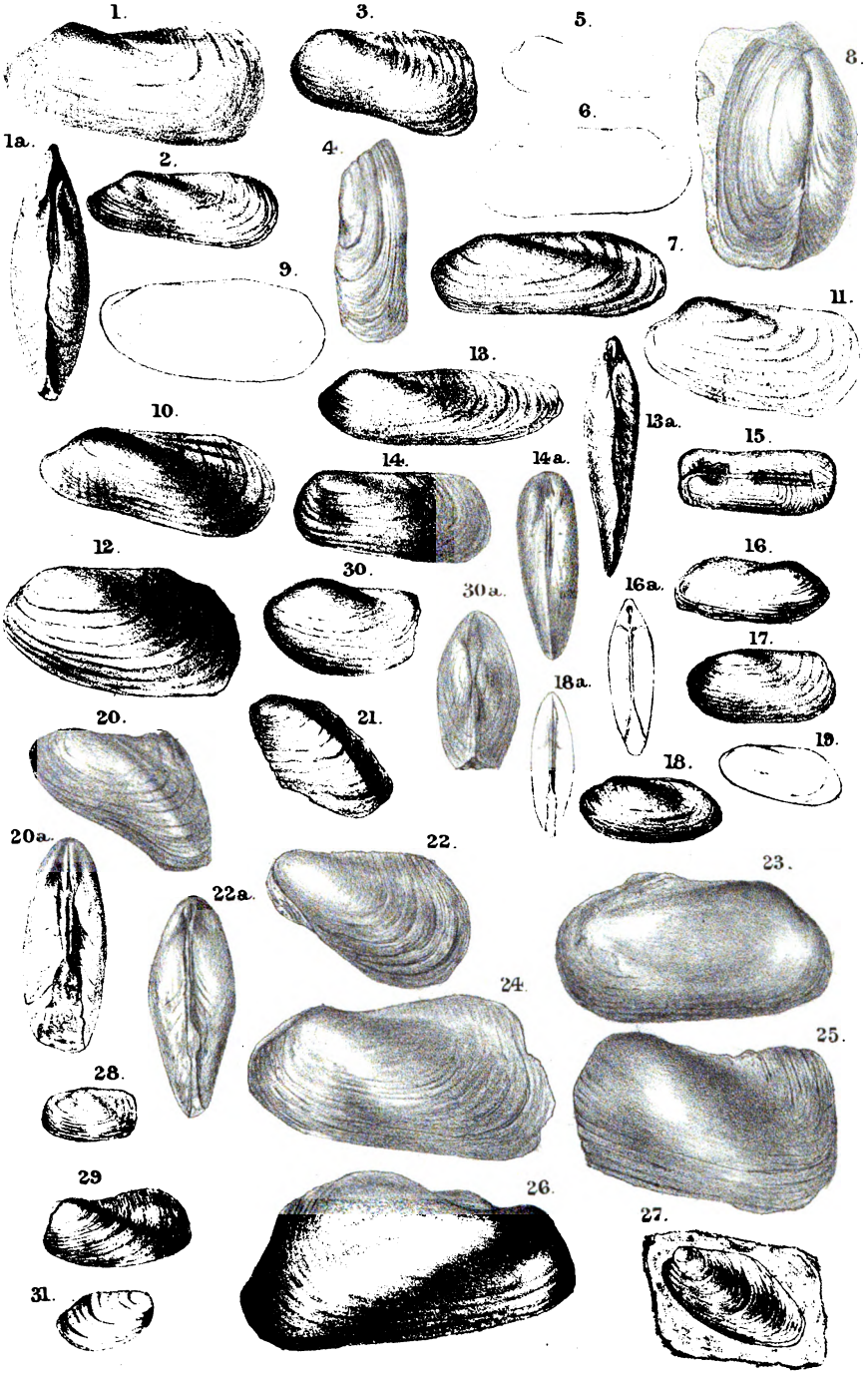


M.H. Manfield del. R. Mintern lith. Mintern Bros. imp.

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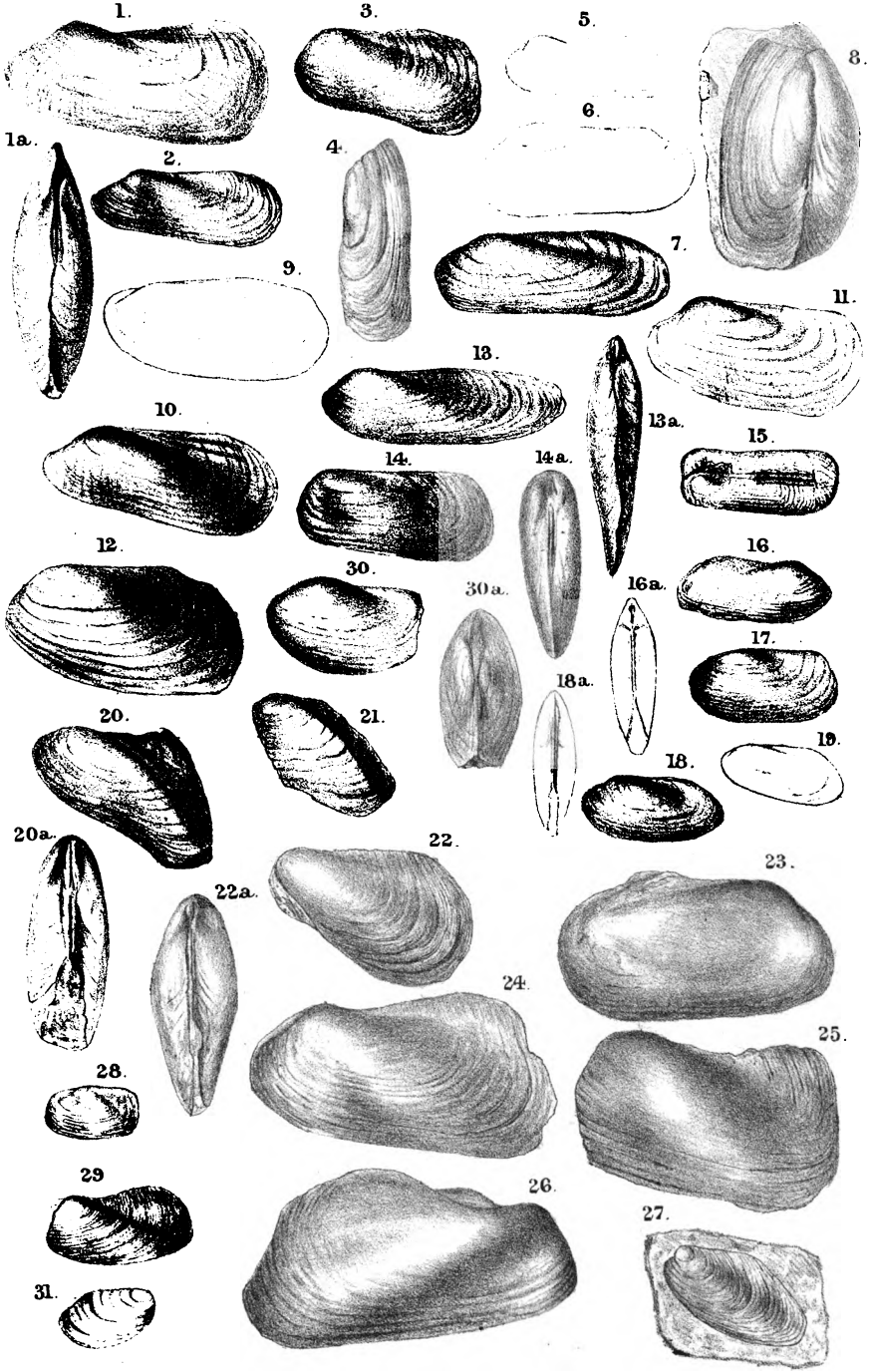
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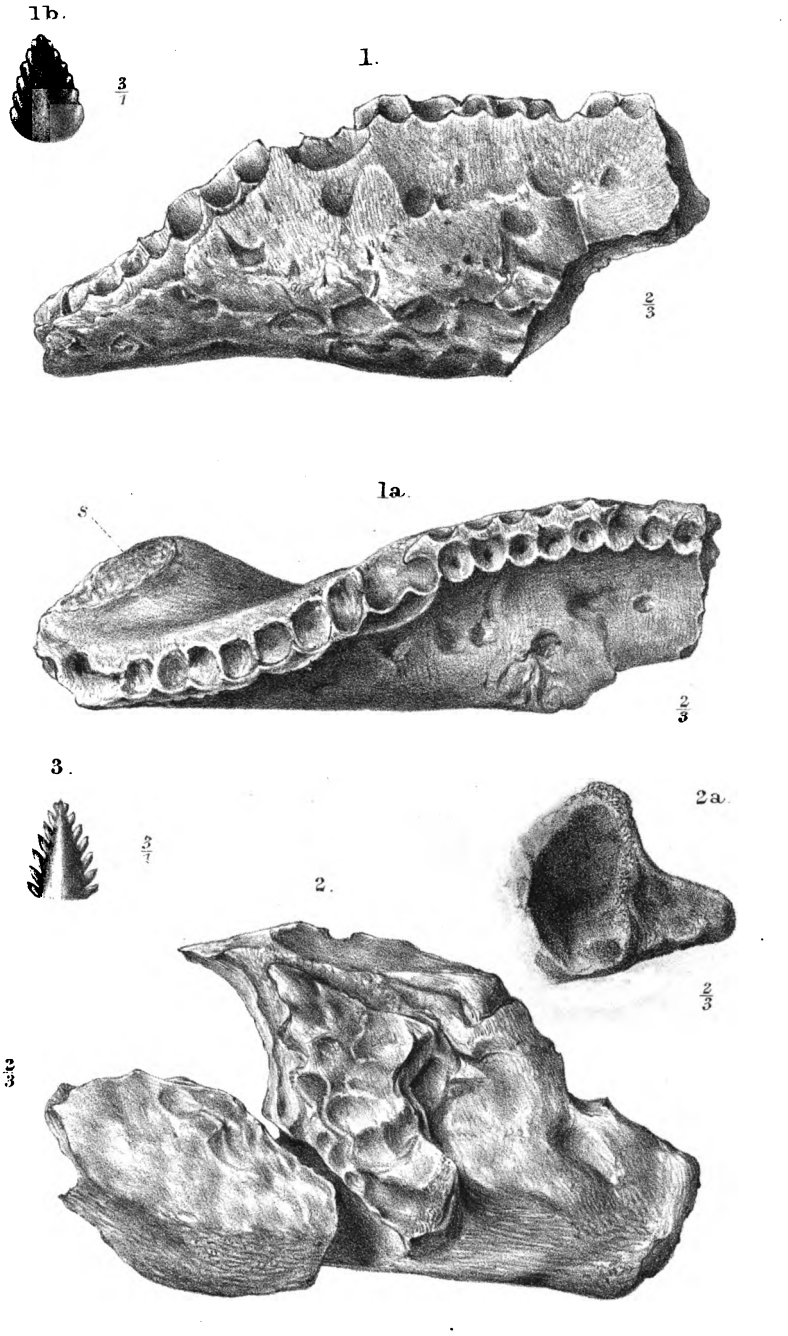


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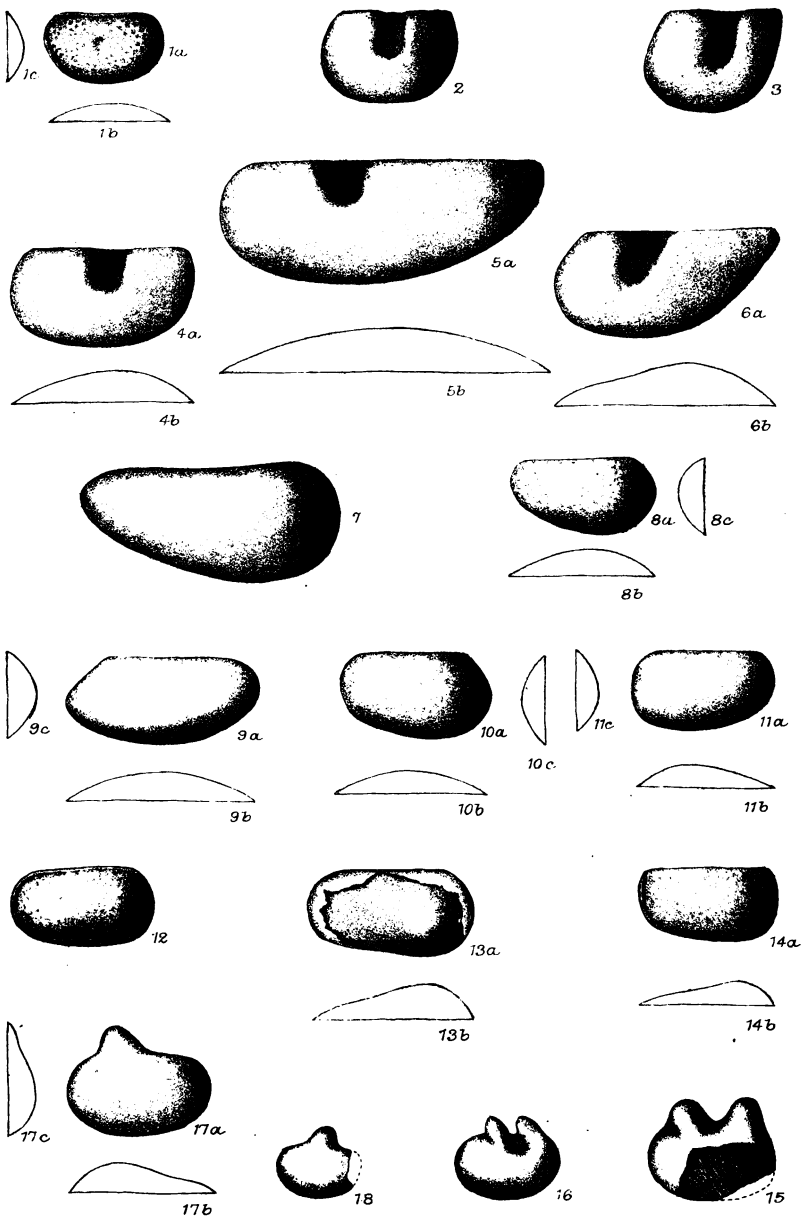
J. Green del. et lith.

Mintern Bros. imp.

SARCOLESTES LEEDSI.

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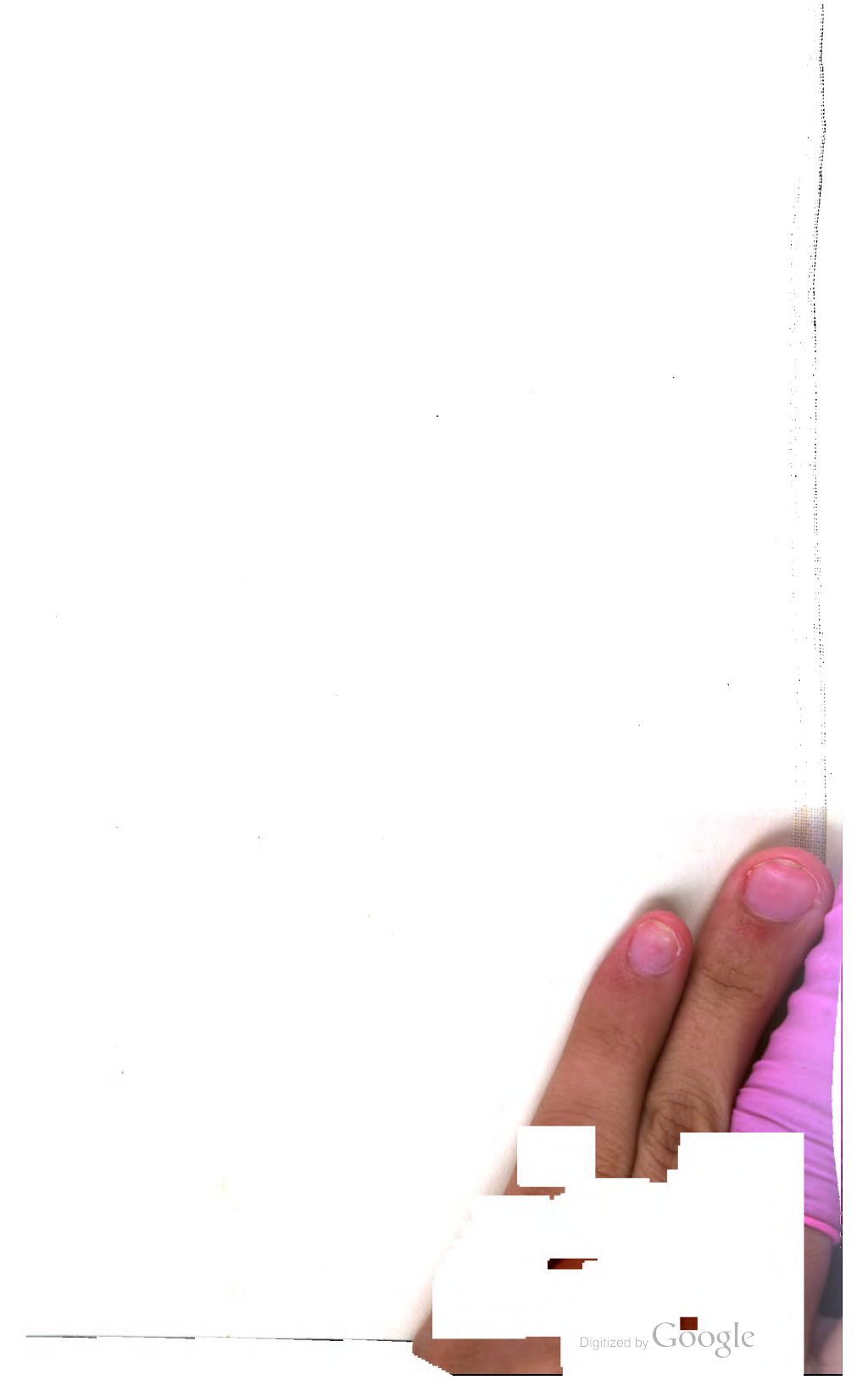
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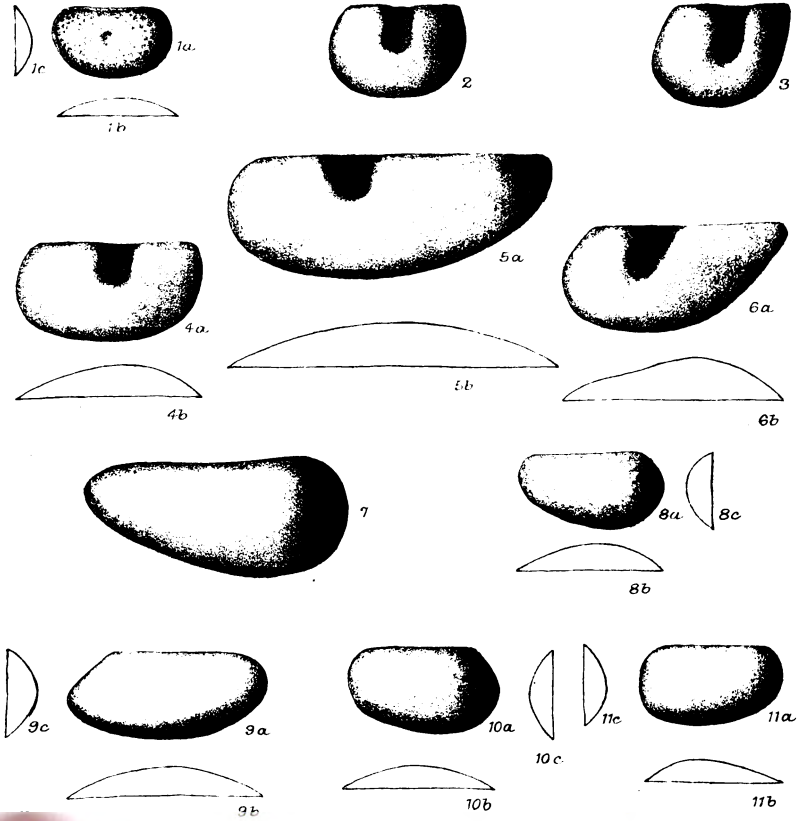


E.C Knight del. et lith. West, Newman imp.

OSTRACODA FROM WESTMORELAND.

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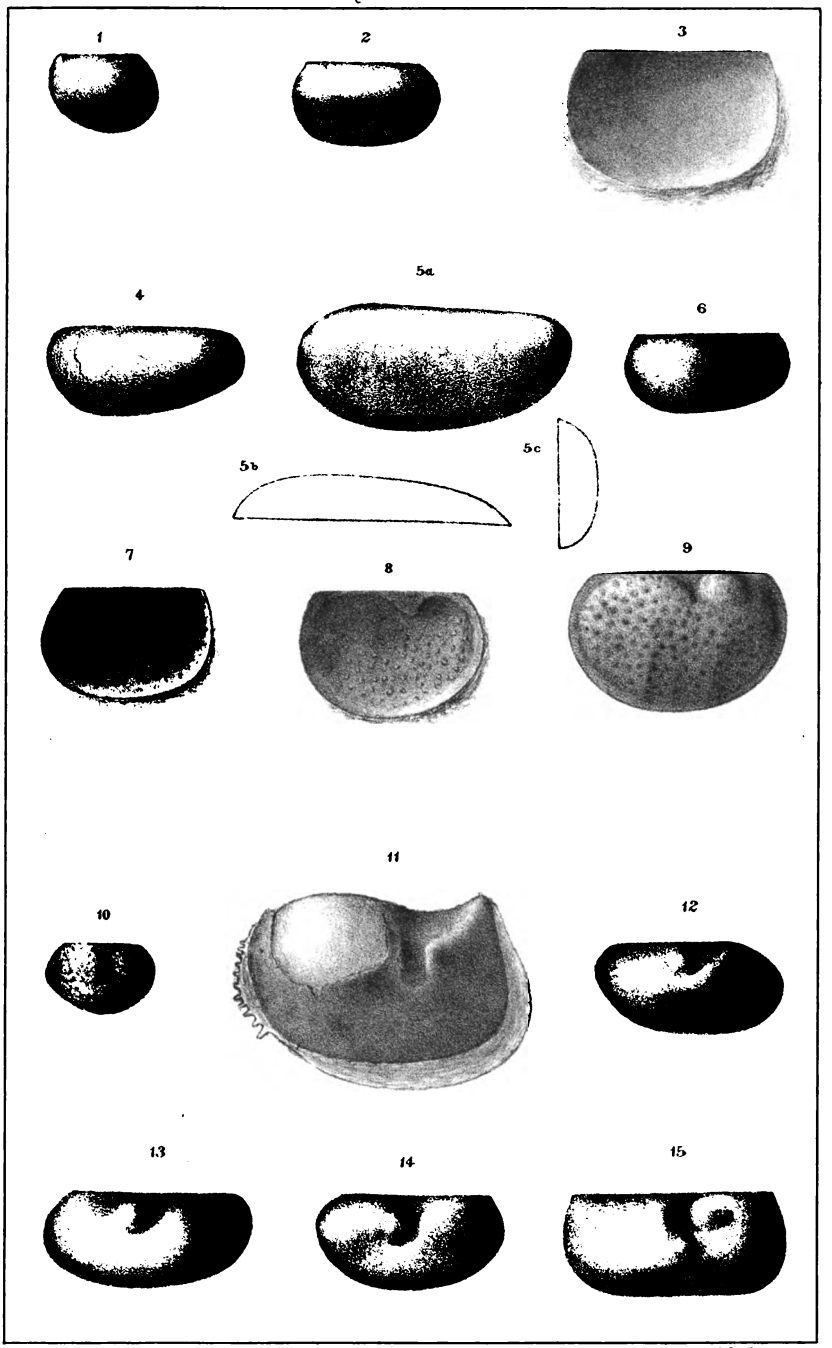


West, Newman

CODA FROM WESTMORELAND.

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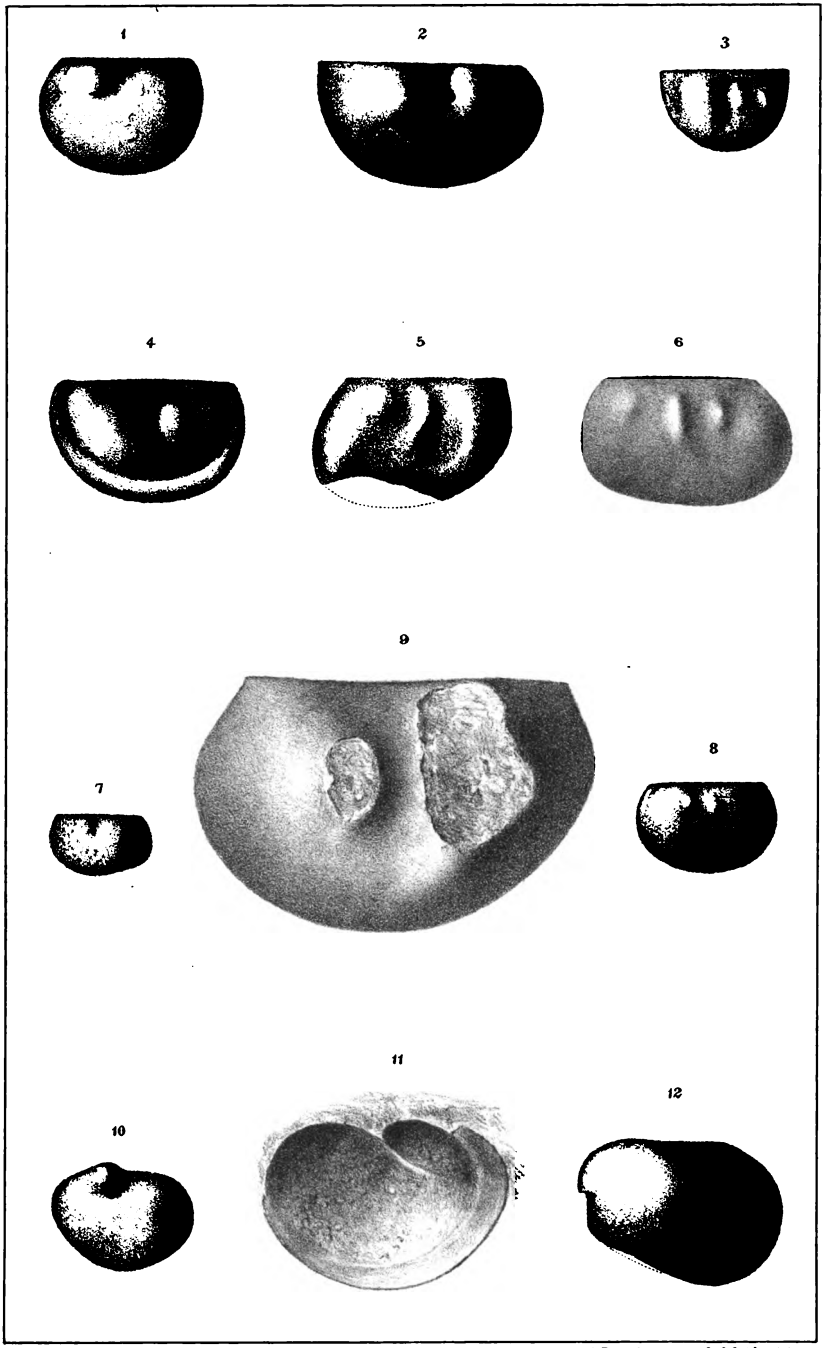


Geo. West & Sons del. lith. et imp.

PALÆOZOIC ENTOMOSTRACA FROM GIRVAN.

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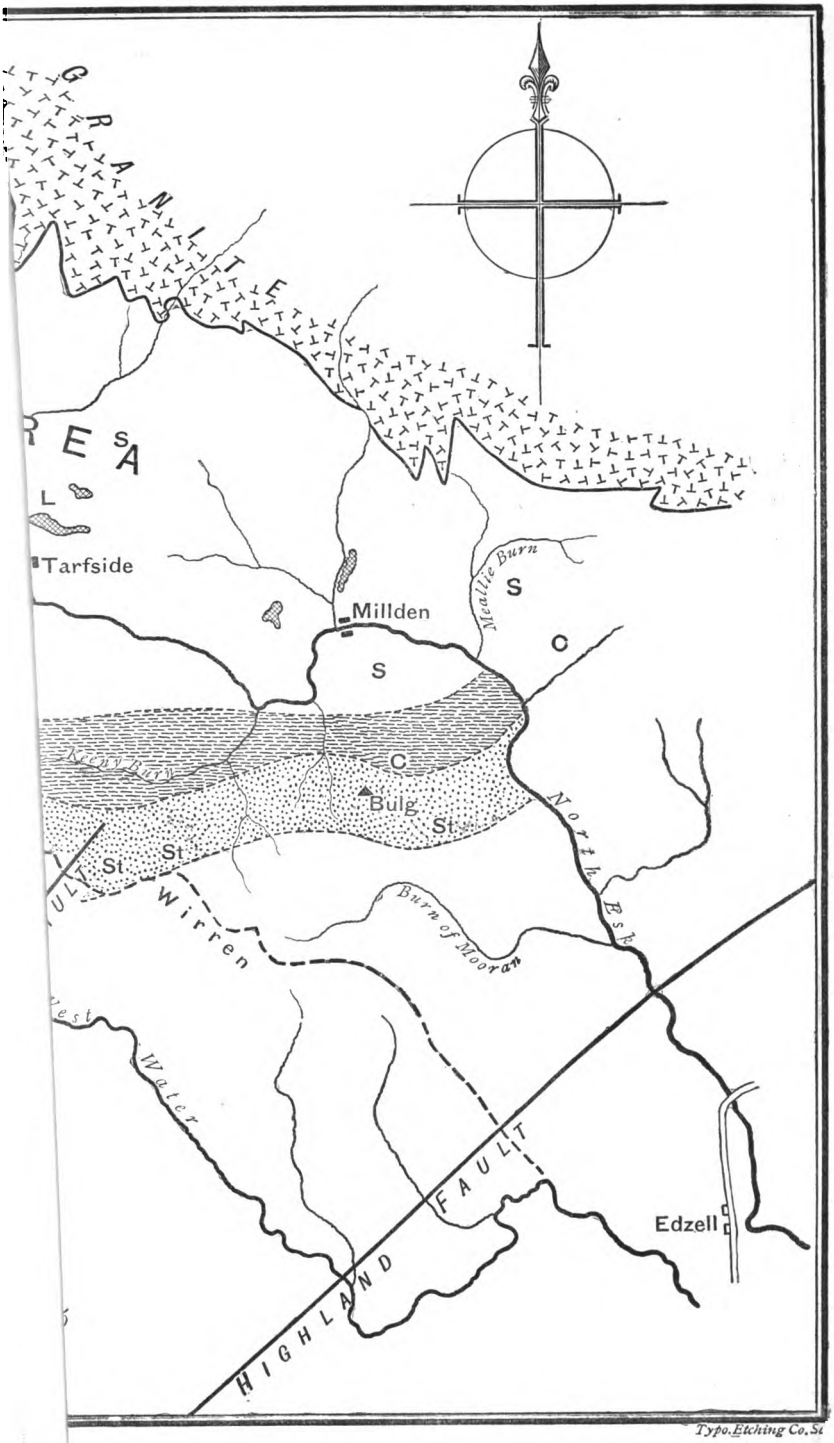


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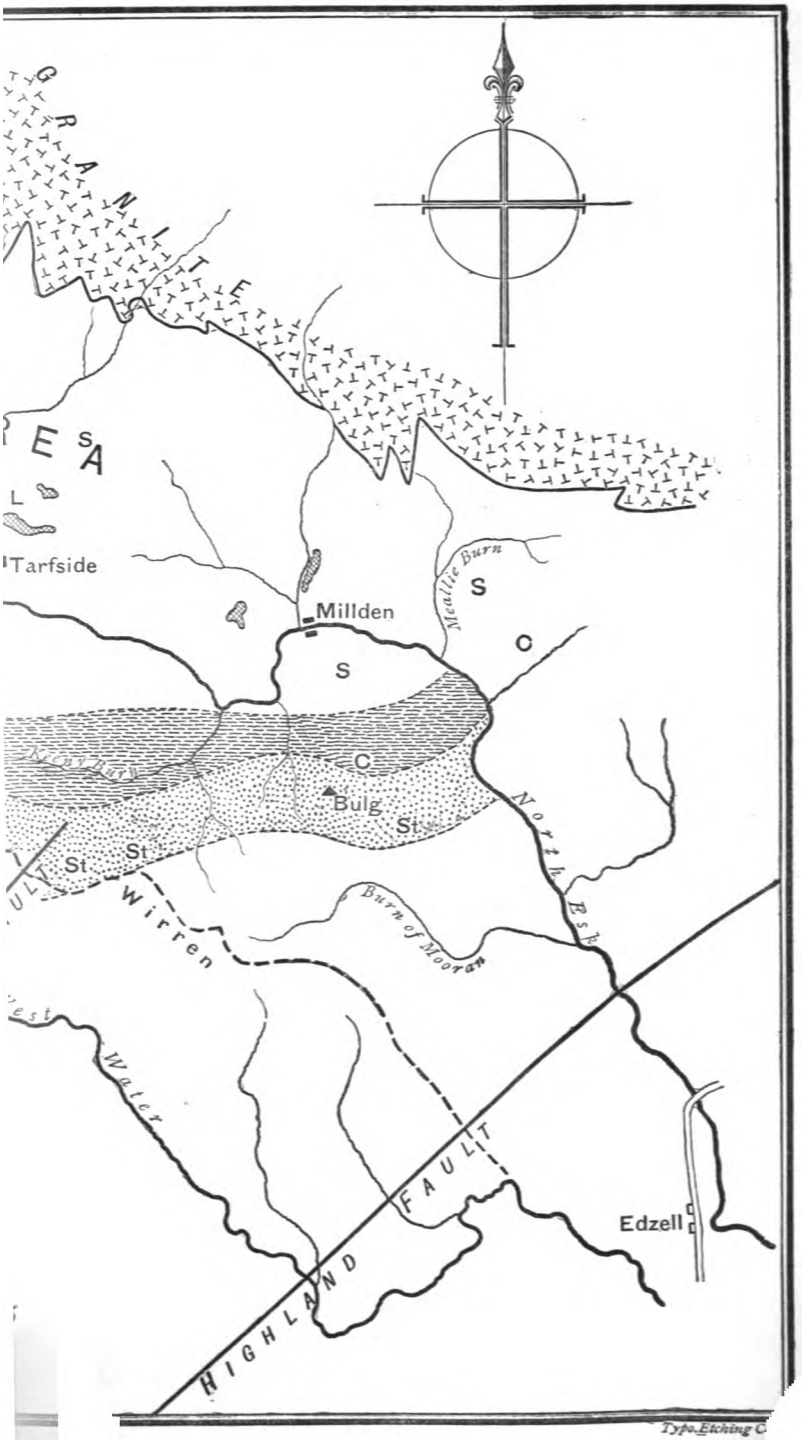


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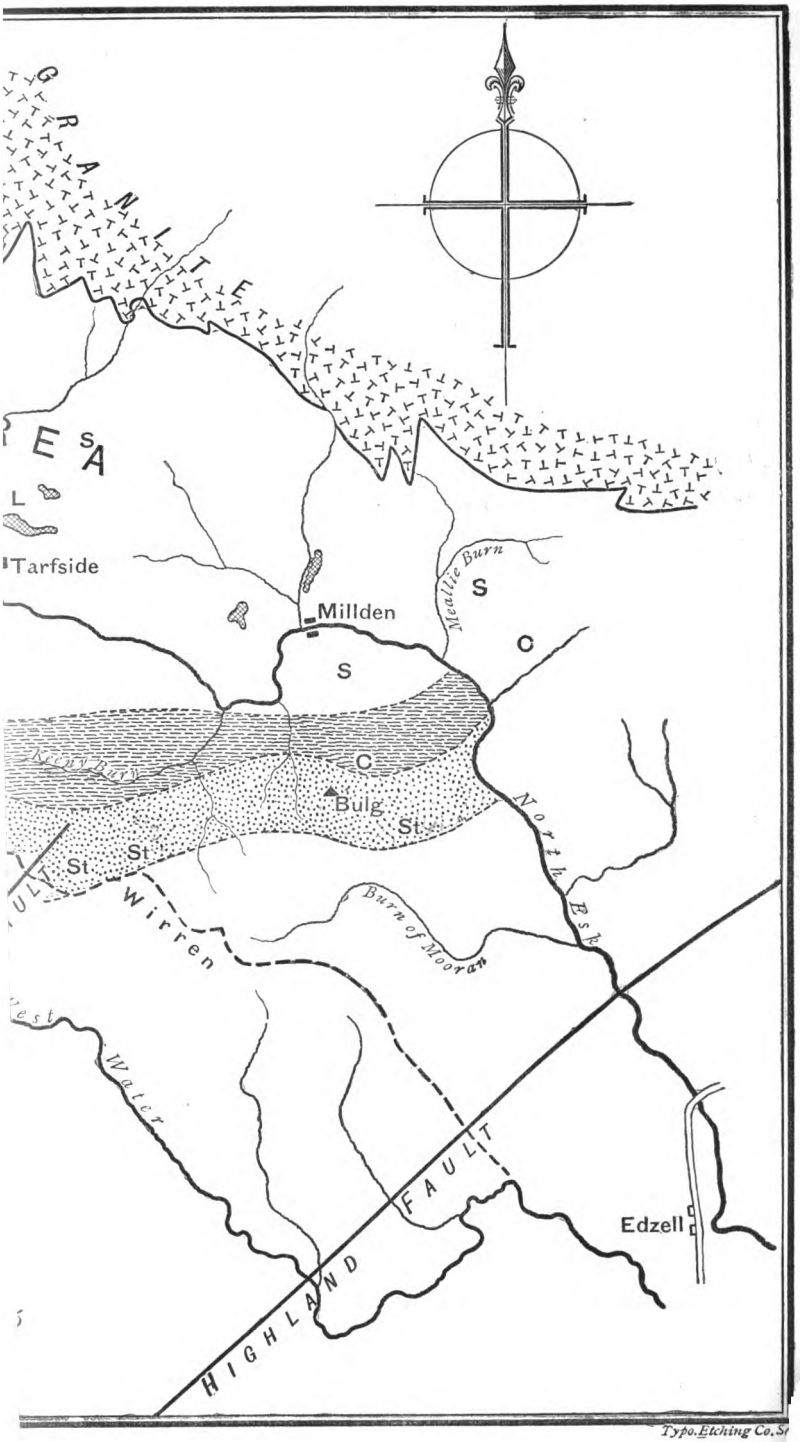


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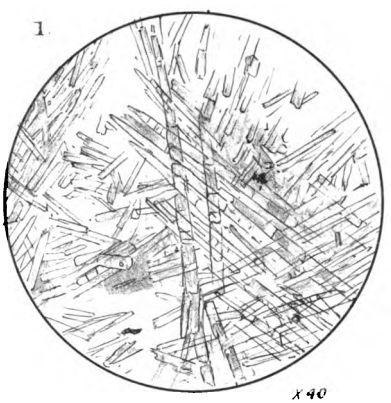
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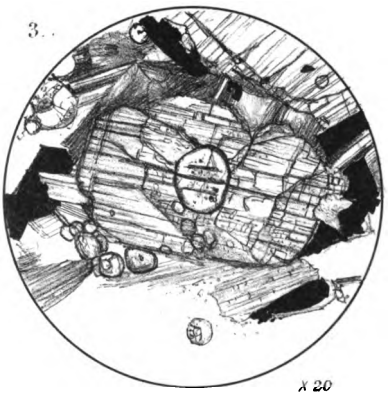
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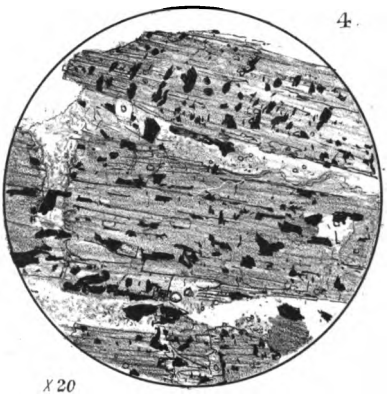
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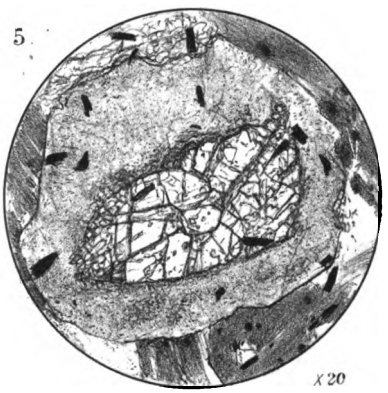
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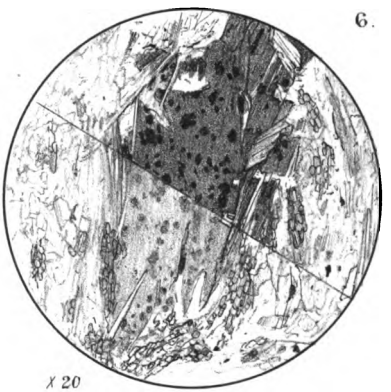










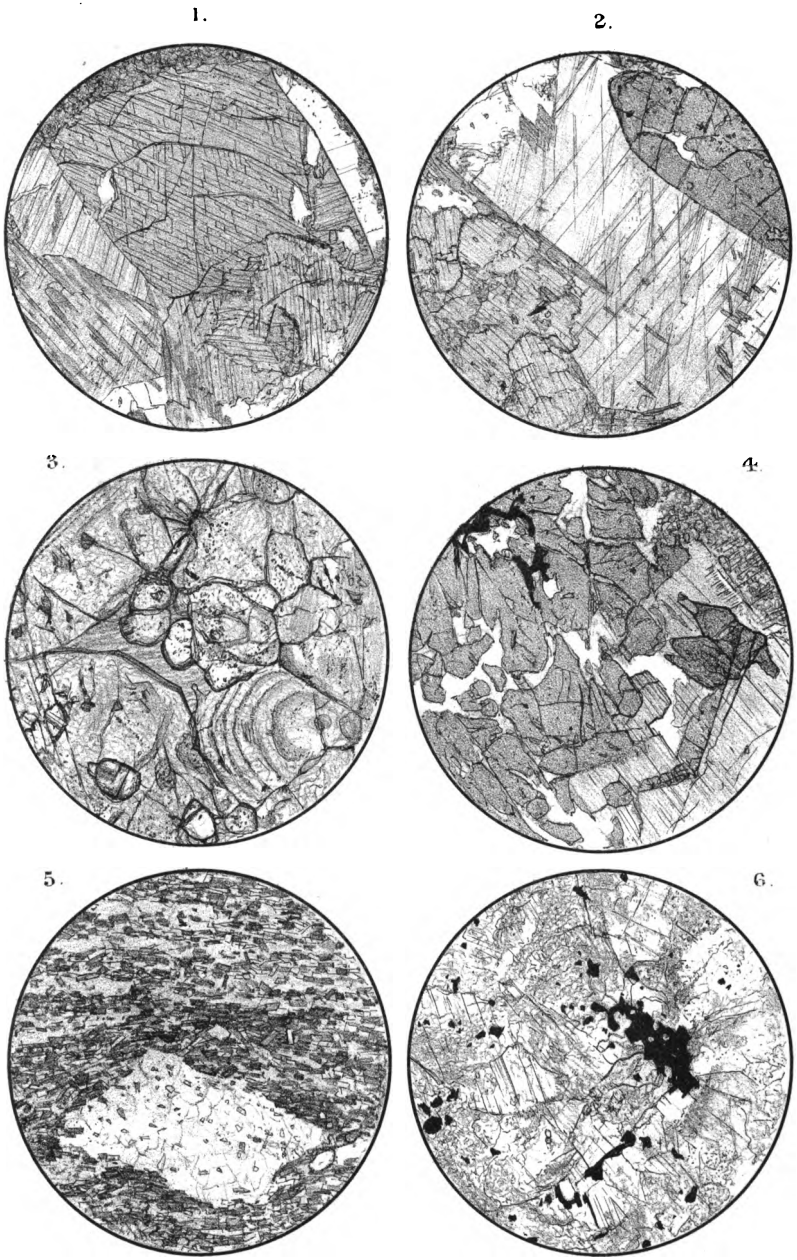


F.H Michael del. et lith. Mintern Bros. imp.

MINERALS DEVELOPED BY THERMOMETAMORPHISM OF MUSCOVITE BIOTITE-GNEISS.

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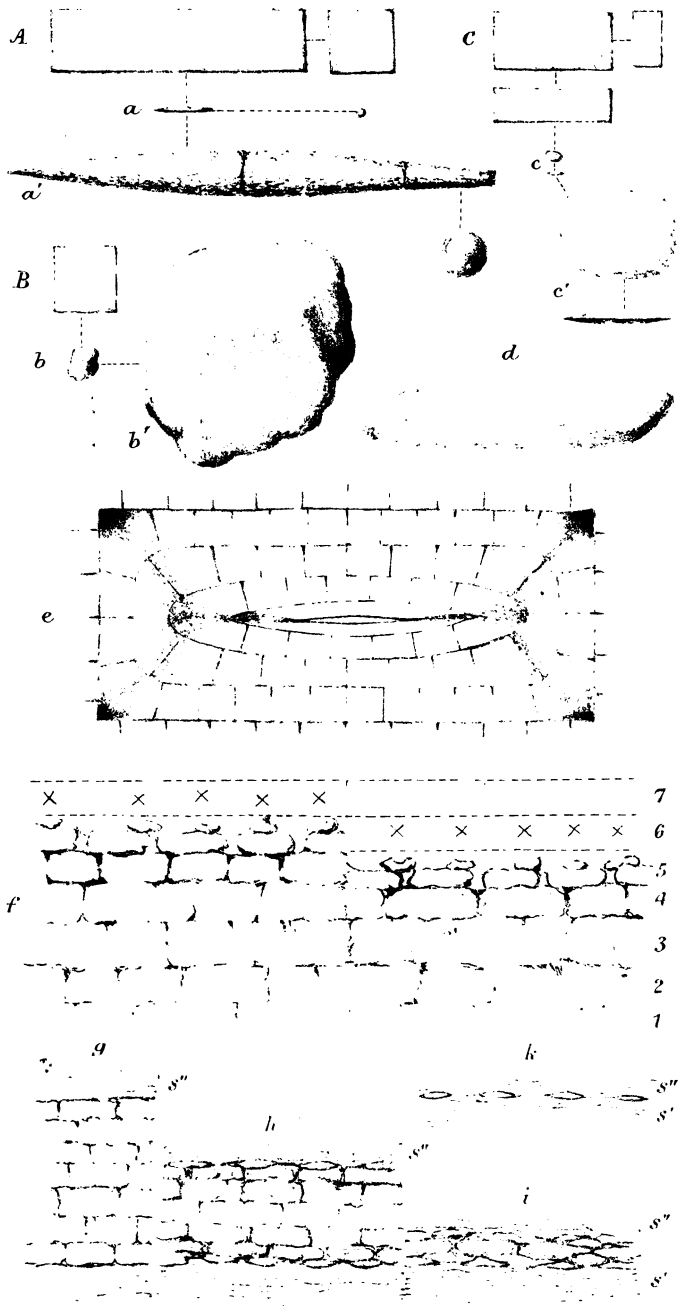


A. Harker del. F. H. Michael lith. Mintern Bros. imp.

SECTIONS OF METAMORPHIC ROCKS, SHAP

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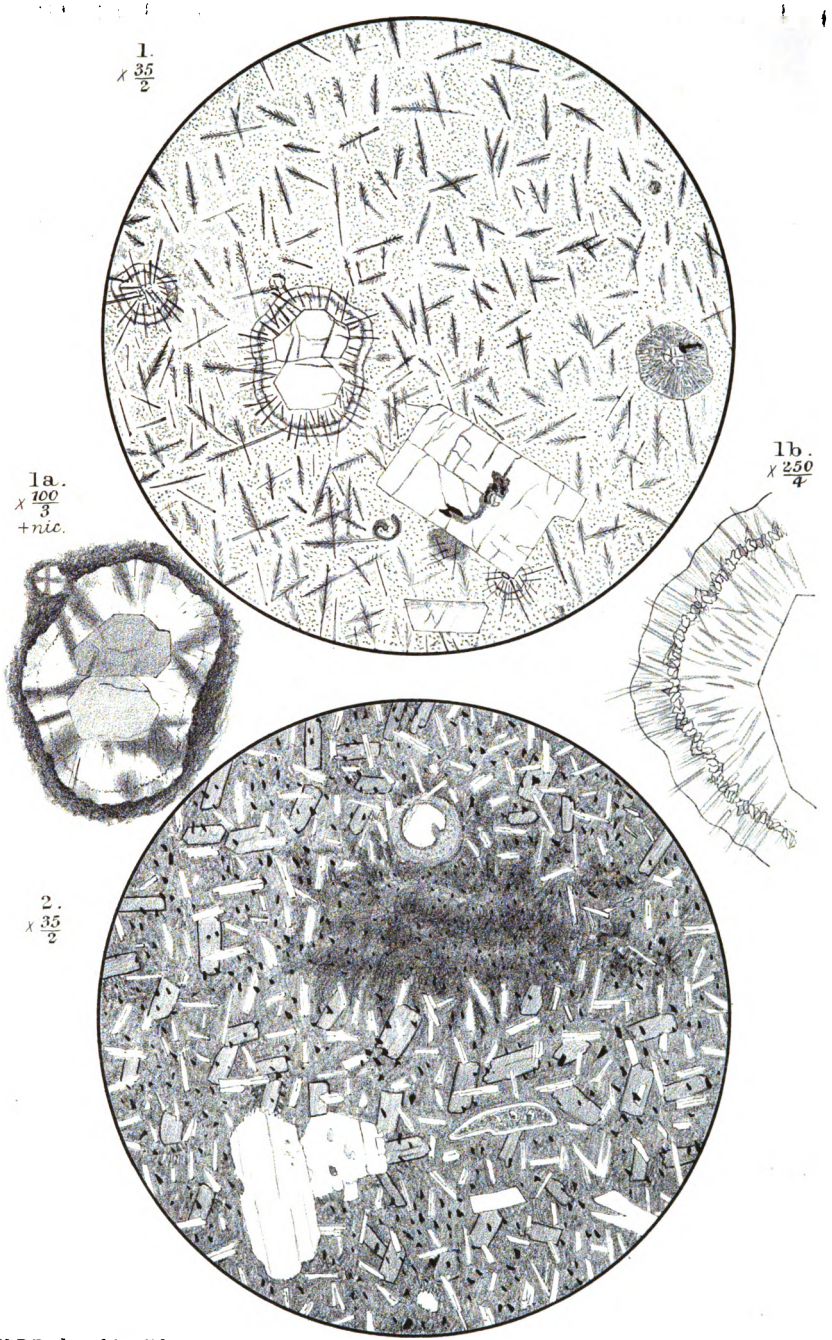


F. Bailey del. Mintorn Bros. lith.

FORMATION OF LIMESTONE-NODULES.

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M. P. Parker del. et lith. Mintern Bros. imp.

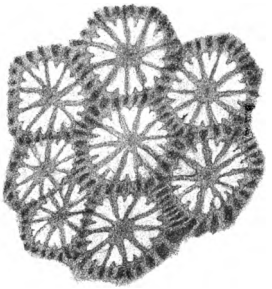
PITCHSTONE AND ANDESITE OF THE CIR MHOR DYKE.

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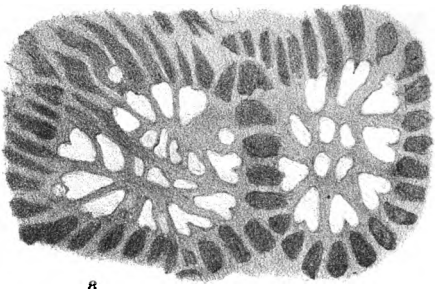
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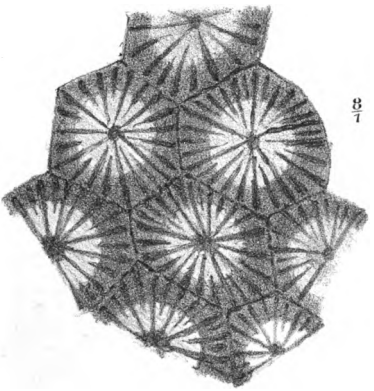
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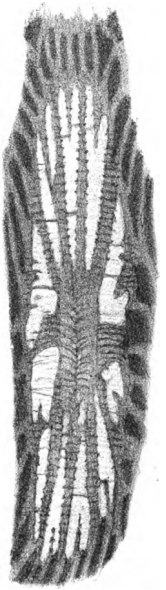
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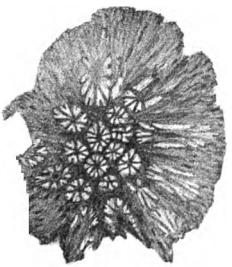
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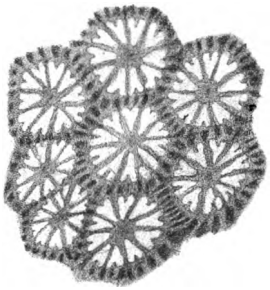
del. F.H.Michael lith.

ASTROCŒNIA AND STELIDIO

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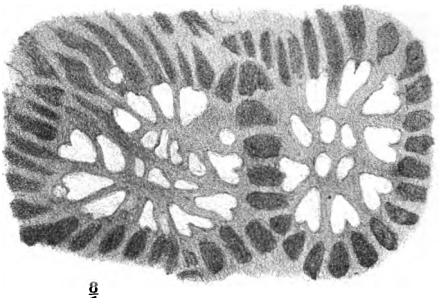
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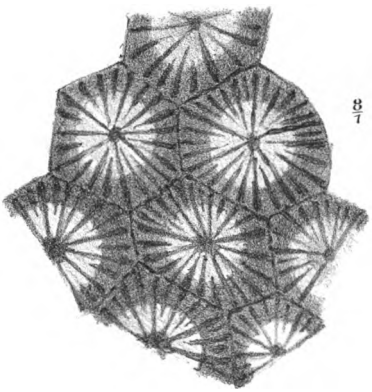
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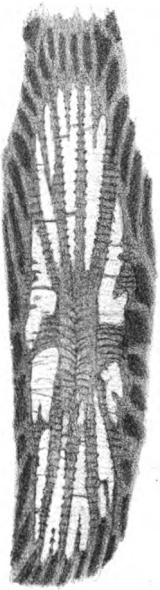
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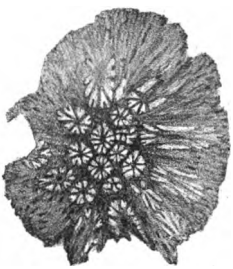
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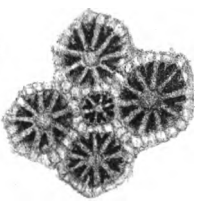
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R. F. Tomes del. F. H. Michael lith. Mintern Bros. imp.

ASTROCŒNIA AND STELIDIOSERIS.

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